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CHARACTERIZATION AND EVALUATION OF WASTEWATER SOURCES, UNITED STATES STEEL CORPORATION, HOMESTEAD WHEEL AND AXLE PLANT, MC KEES ROCKS, PENNSYLVANIA, AUGUST 21-28, 1975

National Enforcement Investigations Center

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The United States Steel Corporation (USSC) Homestead Works consists of three separate areas. The Carrie Furnace area and the Main Homestead area are on the Monongahela River, about 14.5 km (9 mi) upstream of the confluence of the Ohio, Monongahela and Allegheny Rivers. The Wheel and Axle works is on the Ohio River at McKees Rocks, Pennsylvania, about 4.8 km (3 mi) downstream from the confluence of the three rivers. The McKees Rocks plant consists of the older manufacturing area containing the permitted discharges, and the newer area containing mostly dry operations (Fig. 1). Wastewaters are discharged through three outfalls: 018, 019 and 020. All three outfalls discharge to the Graham Street storm sewer which flows into the Ohio River, about 0.8 km (0.5 mi) east of the plant property. On June 12, 1975, NEIC was requested to assist Region III in investigating specific USSC discharges. A reconnaissance of the Homestead Works including the Wheel and Axle plant was conducted on July 23, 1975.

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ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

CHARACTERIZATION AND EVALUATION OF WASTEWATER SOURCES
UNITED STATES STEEL CORPORATION

HOMESTEAD WHEEL AND AXLE PLANT
MC KEES ROCKS, PENNSYLVANIA

August 21-28, 1975

January 1976

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER - Denver, Colorado

and

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CONTENTS

I	INTRODUCTION	1
II	SUMMARY	4
III	MONITORING PROCEDURES	9
IV	MONITORING RESULTS	12
	OUTFALL 018	17
	OUTFALLS 019 AND 119	27
	OUTFALL 020	30
	GRAHAM STREET SEWER	31
	EVALUATION OF WASTE OIL TREATMENT FACILITY	32
V	MONITORING REQUIREMENTS	39

APPENDIX

A	HOMESTEAD WORKS RECONNAISSANCE
B	FIELD STUDY METHODS
C	CHAIN OF CUSTODY PROCEDURES
D	ANALYTICAL PROCEDURES, QUALITY CONTROL
E	MARSH-MC BIRNEY FLOW METER

TABLES

1	Industrial Waste Sampling	10
2	Process Status	13
3	Production Data, August 1975	14
4	Production Data, January-June 1975	15
5	Field Measurements and TSS	18
6	Daily Oil and Grease Characteristics	19
7	Grab Sample Analysis, O/G	20
8	Instantaneous Oil and Grease Loads	21
9	Summary of Metals Analyses	22
10	Self-Monitoring Data	23
11	Monitoring Schedule	24
12	Waste Loads per Unit Production	26
13	Organic Compounds	33
14	Waste OTP Evaluation	35
15	Recommended Monitoring Requirements	40

FIGURES

1	Homestead Wheel and Axle Plant	2
2	Wastewater Treatment Facility Flow Diagram	34
3	Wheel Mill Separator	36

I. INTRODUCTION

The United States Steel Corporation (USSC) Homestead Works consists of three separate areas. The Carrie Furnace area and the Main Homestead area are on the Monongahela River, about 14.5 km (9 mi) upstream of the confluence of the Ohio, Monongahela and Allegheny Rivers. The Wheel and Axle works is on the Ohio River at McKees Rocks, Pennsylvania, about 4.8 km (3 mi) downstream from the confluence of the three rivers.

The McKees Rocks plant consists of the older manufacturing area containing the permitted discharges, and the newer area containing mostly dry operations [Fig. 1]. Railroad car axles and wheels are manufactured at this plant from axle blooms and wheel blanks made at the Main Homestead Plant.

Wastewaters are discharged through three outfalls: 018, 019 and 020.* All three outfalls discharge to the Graham Street storm sewer which flows into the Ohio River, about 0.8 km (0.5 mi) east of the plant property. USSC reported that outfall 018 contained 2,400 m^3/day (0.64 mgd) of untreated cooling water from the axle forge furnaces. Process wastes in this sector are treated in an oil-water separator; the overflow from this separator, approximately 190 m^3/day (0.05 mgd), is piped to the oil treatment facility. The separated oil is stored in an elevated tank and hauled away by a commercial reclaimer. Outfall 019 receives about 1,970 m^3/day (0.52 mgd) of cooling water from the wheel rolling mill, 3,550 m^3/day (0.94 mgd) of untreated water from the power house, and 2,915 m^3/day (0.77 mgd) of effluent from the oil treatment facility.

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* *Outfalls 001 through 017 are located at the Carrie Furnace and Main Homestead areas.*

GATE

NEW BUILDINGS AND STORAGE FACILITIES ACQUIRED BY
WHEEL AND AXLE DIVISION APPROXIMATELY 4 YEARS AGO

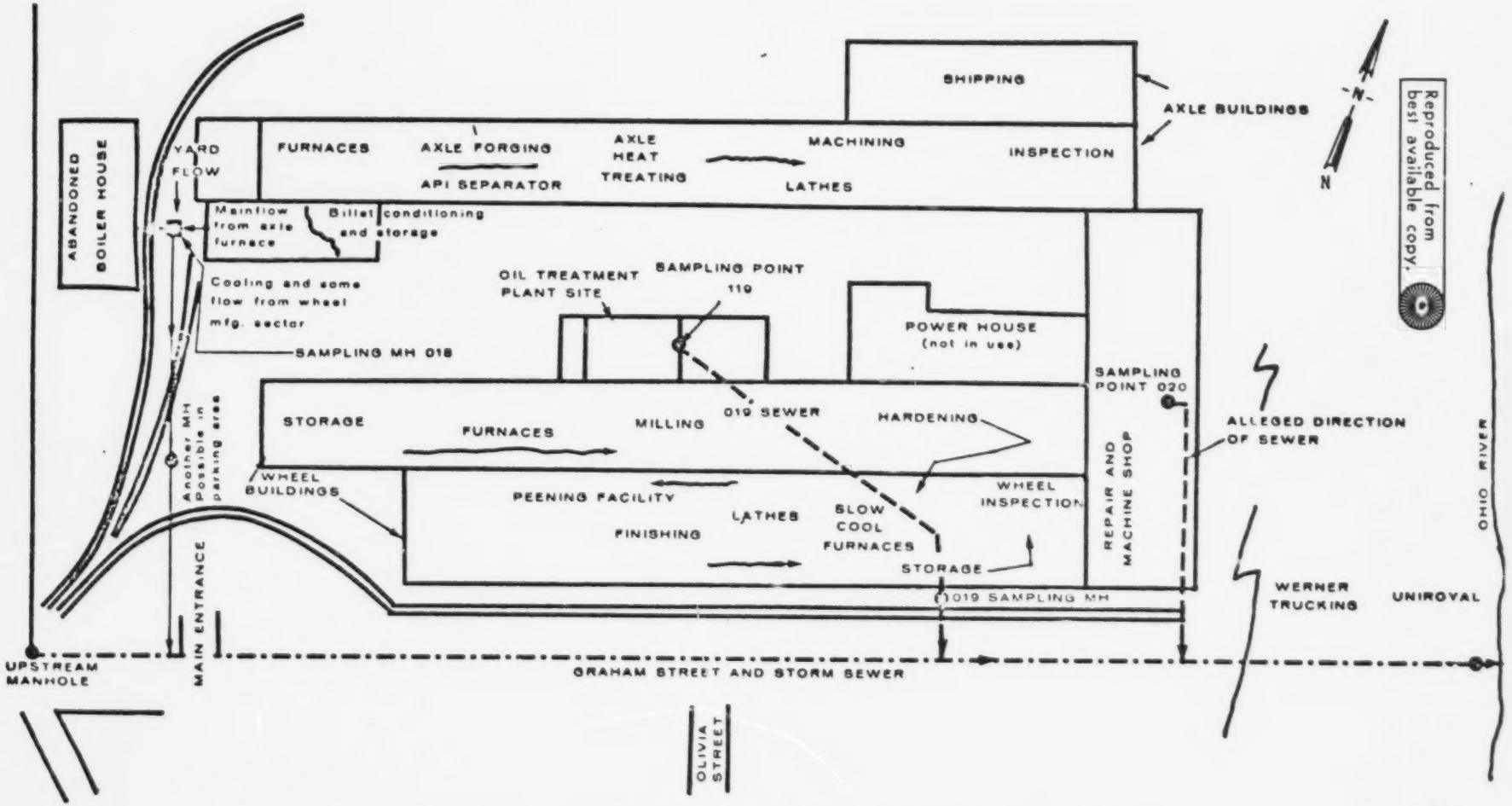

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Figure 1. USSC Homestead Wheel and Axle Division Plant, McKees Rocks, Pennsylvania
JULY 1975

USSC has designated the effluent from the treatment facility as intermediate location no. 119 for monitoring purposes. Influent to the oil treatment plant is comprised of 2,725 m^3/day (0.72 mgd) process water from the wheel mill plus the oil separator overflow from the axle forge sector. Outfall 020 contains a minor cooling water discharge from the machine shop quenching operation. USSC has withdrawn its application to discharge through this outfall.

The plant obtains its water from a series of 5 or 6 wells on plant property. Potable water is purchased from the municipality. Total water supply currently amounts to 3,785 m^3/day (1 mgd).

On June 12, 1975, NEIC was requested to assist Region III in investigating specific USSC discharges. A reconnaissance of the Homestead Works including the Wheel and Axle plant was conducted on July 23, 1975 [Appendix A]. In-plant monitoring of the waste sources and an evaluation of the oil treatment facility was conducted on August 21-28, 1975. This report summarizes the results of this monitoring.

II. SUMMARY

1. During August 21-28, 1975, the wastewater discharges from outfalls 018, 019, 020, intermediate location 119, and the Graham Street storm sewer were monitored. The two influents and the effluent from the oil treatment facility were also monitored to determine treatment efficiency. Flows were measured with NEIC and USSC devices, and pollutant loads were calculated for each location except the Graham Street sewer (for which flows were not measured).

2. Based on total production figures supplied by USSC for the first six months of 1975 and August 21-28, the mill was operating at production levels about 25% greater during the survey than in January through June.

3. Outfall 018 contains only cooling water from the axle forge sector. Company officials reported flows of 2,400 m^3/day (0.64 mgd). During NEIC monitoring, flows ranged from 1,970 m^3/day (0.52 mgd) to 3,745 m^3/day (0.99 mgd) and averaged 2,725 m^3/day (0.72 mgd). The NEIC monitoring data indicate that the discharge is essentially the only cooling water, however oils or lubricants may also be discharged from this outfall. All parameters tested were at detectable limits or very low (except for oil/grease). USSC self-monitoring data also confirms the NEIC data. The maximum oil/grease concentration found by NEIC was 16 mg/l; all other concentrations were 6 mg/l or less. USSC data had oil/grease concentrations ranging from 0.1 to 22 mg/l. On a unit production basis, the average total suspended solids (TSS) and average oil/grease loads over the seven days were as follows:

Total Production† (m.tons)	(tons)	TSS (kg/1,000 kg)	(lb/ton)	Oil/Grease (kg/1,000 kg)	(lb/ton)
504	556	<0.06	<0.11	<0.01	<0.02

† *Wheels and Axles*

USSC has not proposed limitations for this outfall in their request for an adjudicatory hearing.

4. Outfall 019 consists of untreated cooling water, water from the power house, and the effluent from the oil treatment plant (intermediate location 119 as designated by USSC). The total flow was reported as approximately 8,300 m^3/day (2.2 mgd). During the NEIC survey, the flows through outfall 019 ranged from 5,225 m^3/day (1.38 mgd) to 6,470 m^3/day (1.71 mgd) and averaged 6,140 m^3/day (1.62 mgd), or about 75% of the reported flow.

USSC has proposed that TSS and oil/grease be monitored at location 119 instead of 019. However, even though oil/grease and TSS concentrations were essentially equivalent at both locations, the loads must be calculated on the total flow through outfall 019. Using the oil/grease concentrations from location 119 and the flow from outfall 019, the oil/grease load calculated is about 25% less than the oil/grease load discharged through outfall 019, using flows and concentrations measured at outfall 019. Since outfall 019 contains flow from all waste sources in the wheel mill, power house, etc., while 119 consists of only one waste source, monitoring should remain at outfall 019.

USSC has also proposed limitations for TSS and oil/grease (to be monitored at 119) for the life of the NPDES permit. The proposed limitations and the NEIC monitoring data are as follows:

Parameter	USSC Proposed Limitations (119)				Survey Data (019)			
	Daily Average		Daily Maximum		Daily Average		Daily Maximum	
	(kg/day)	(lb/day)	(kg/day)	(lb/day)	(kg/day)	(lb/day)	(kg/day)	(lb/day)
TSS	423	930	1,269	2,790	78	173	143	315
O/G	236	520	708	1,560	62	137	149	329

TSS and oil/grease loads were less than 20% and 30% of the daily average proposed limitations. The maximum loads discharged for TSS and oil/grease were only 10% and 21%, respectively, of the proposed maximum loads. Using the USSC proposed limitations and the flow through outfall 019, the average and maximum allowable concentrations would be 40 and 115 mg/l, respectively.

On a unit production basis for August 21-28, the average loads discharged are compared with the proposed limitations.

Parameter	Daily Average Waste Load					
	USSC Proposed		Actual (Aug. 21-28)			
			Outfall 019		Location 119	
	(kg/1,000 kg)	(lb/ton)	(kg/1,000 kg)	(lb/ton)	(kg/1,000 kg)	(lb/ton)
TSS	0.84	1.67	0.15	0.31	0.03	0.07
O/G	0.47	0.94	0.12	0.25	0.01	0.03

5. Outfall 020, a non-permitted discharge,* contains quench water from the machine shop. The flow averaged 8 m^3/day (2,300 gpd). TSS and oil/grease levels were insignificant during August 21-28. However,

* *USSC withdrew application for this outfall.*

self-monitoring data show TSS and oil/grease concentrations much greater than those found during the NEIC survey. The TSS concentrations reported by USSC ranged from 9 to 156 mg/l and oil/grease concentrations from 2 to 73 mg/l. NEIC personnel observed that quenching operations were not being conducted whenever NEIC samples were collected. Therefore, the self-monitoring data indicate that pollutants are discharged from quenching operations.

6. The discharge from the Graham Street storm sewer at the Ohio River, and a location in this sewer immediately above USSC's connections to the sewer,* were monitored to determine if USSC had additional connections not reported. The data indicate that there are no additional connections from the Wheel and Axle plant.

On August 25, a grab sample collected from the storm sewer discharge to the Ohio River had low levels of organic compounds. Since the compounds were not found in USSC's outfalls, they must have originated downsewer from the USSC facility. The compounds, consisting of petroleum hydrocarbons, ranged from C_9 to C_{20} and appeared in a uniform pattern, suggesting light-weight refined oils.

7. Due to fluctuations in USSC's effluent flow measuring device (location 119), the degree of TSS and oil/grease removals in the waste oil treatment facility could only be approximated. The treatment process removed approximately 95% of the influent oil/grease load and 38% of the influent TSS load. The low solids removal efficiency is partially attributed to the operating pH range of 5.4-7.5. Since the effluent TSS concentration is <14 mg/l, additional solids removal is not warranted. Effluent oil/grease concentrations ranged from 1-24 mg/l and averaged 6 mg/l over the seven-day period.

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* *Flows were observed upstream of USSC's connections to the storm sewer on one occasion, during a rain storm.*

8. During the reconnaissance, USSC personnel stated that all wastewater from the wheel mill flowed to the oil treatment facility. Drawing no. BB-7410, submitted by USSC in response to the 308 Request dated August 11, 1975, shows an intermittent flow from a sonic tester sump to the wheel rolling mill flume containing up to 100,000 ppm oil. About 1,890 l/min (500 gpm) of wastewater containing 200 ppm oil and 100 ppm TSS flows from this flume to the wheel mill oil separator prior to discharge to the oil treatment facility. USSC personnel did not mention this separator during the reconnaissance nor during the survey; therefore, it is unknown by NEIC personnel if all waste oil is directed to the oil treatment facility.

9. USSC reports that total water pumped from their wells averaged about 3,445 m^3/day (0.91 mgd) for January through June, 1975; during the reconnaissance, USSC reported that the total water supply to the plant averages 3,785 m^3/day (1 mgd). In their response to the 308 Request, USSC stated that 120 m^3/day (31,823 gpd) of sanitary wastes are discharged to the Allegheny County Sanitary District. Effluent flows on August 21-28 averaged 8,865 m^3/day (2.34 mgd), and USSC previously reported in the reconnaissance a total effluent flow of 10,750 m^3/day (2.8 mgd). Therefore, based on the estimated intakes and measured effluents, about 3,785 m^3 (1 X 10^6 gal) flows into the plant and about 9,000 m^3 (2.4 X 10^6 gal) flows from the plant per day. It is apparent that USSC's methods of determining flows are not accurate or realistic. USSC only measures flows from the waste oil treatment facility; all other flows are estimated.

III. MONITORING PROCEDURES

Eight locations were sampled during the seven-day period, August 21-28, 1975, to characterize the wastewater discharges and evaluate the waste oil treatment system [Table 1]. Outfalls 018 and 019, intermediate location 119, and the Graham Street storm sewer (at the discharge to the Ohio River) were sampled daily, including Sunday, August 24, when the entire plant was down. Outfall 020 discharged intermittently, normally only during the first turn,* Monday through Saturday. To determine the USSC net discharge to the Graham Street storm sewer, the latter was monitored upstream of the outfall 018 connection.** This upstream site was dry except during one rain storm. USSC personnel believe that the upstream flow was due to the Graham Street sewer backing up rather than from upstream discharges. The influent to the waste oil treatment plant from the wheel mill flowed on all 7 days; however, there was essentially no influent flow from the axle sector on Sunday and Monday.

All composite samples were combined on a flow-weighted basis except samples collected at the Graham Street storm sewer outfall. The composite samples from the latter were combined on an equal volume basis. Continuous flows were obtained for outfalls 018 and 119; instantaneous flows were measured each time a sample was collected at the remaining locations, and total daily flows were calculated from the instantaneous flows. Only grab samples were collected from the upstream manhole on the Graham Street storm sewer during the rain storm. Details on sampling procedures

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* *A turn is equivalent to an 8-hour shift.*

** *Upstream location selected was the next upstream manhole in the storm sewer, located in the intersection of Graham St., George St. and Nichol St.*

Table 1

INDUSTRIAL WASTE SAMPLING

USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Station Description	Sample Type	Analyses Performed†								
		TSS	O/G††	Phenol	Total and Dissolved Fe	Total and Hexavalent Cr	Al	Pb	Sn	Organics†††
Outfall 018	Composite	X			X	X	X	X	X	
	Grab		X							X
Influent to Oil Treatment Plant from Wheel Mill Shop	Composite	X								
	Grab		X							
Influent to Oil Treatment Plant from Axle Forge Shop	Composite	X								
	Grab		X							
Effluent from Oil Treatment Plant, Location 119	Composite	X								
	Grab		X	X						
Outfall 019	Composite	X			X	X	X	X	X	
	Grab		X							X
Outfall 020	Composite	X								
	Grab		X							
Graham St. Sewer Upstream of Outfall 018	Composite	X			X	X	X	X	X	
	Grab		X							X
Graham St. Sewer at Discharge to Ohio River	Composite	X			X	X	X	X	X	
	Grab		X							X

† *pH, temperature and flow were measured each time sample was collected at all stations (flow was not measured at either Graham St. sewer location)*

†† *Oil/grease and phenol samples were collected three times during each 24-hour sampling period*

††† *Organics sampled at 10 a.m. on August 25 and 1 p.m. on August 27*

and flow measurement techniques are contained in Appendix B. All samples were collected and analyzed according to Chain of Custody procedures [Appendix C] and analytical quality control procedures [Appendix D].

IV. MONITORING RESULTS

The various processes comprising the Wheel and Axle plant operate on different schedules. USSC personnel, prior to sample collection, verbally provided the following process schedule for the monitoring period:

Process	Number of Turns†	Time	Days
Rolling Mill	1	0800-1600	Mon thru Sat
Axle Forge	3	0800-0800	Tue thru Sat
Circular Section Forging	2	0800-2400	Mon thru Fri
Finishing Areas††	3	0800-0800	Mon thru Fri

† *A turn is equivalent to an 8-hour shift.*
†† *Include wheel, circular section, and axle areas*

The above schedule was not completely followed due to equipment problems and other operational difficulties. The actual process schedule during the NEIC survey is listed in Table 2. The status of a particular process was verbally provided by USSC personnel accompanying the NEIC field teams during sampling periods.

Production data* provided by USSC for the monitoring period is tabulated in Table 3. Production data* for the six-month period January through June 1975 is tabulated in Table 4. The production data from these two periods is summarized below.

* *Data provided by USSC in response to the 308 Request dated August 11, 1975.*

Table 2

PROCESS STATUS
USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Process	Date	Time Period† (hours)	Process Status
Axle Forge	Thur. Aug. 21	0600 - 1800	Down
		2000 - 2400	Up
	Fri. Aug. 22	0001 - 0900	Up
		1200 - 1500	Down
		1800 - 2400	Up
	Sat. Aug. 23	0001 - 1500	Up
		1800 - 2100	Down
	Sun. Aug. 24	0001 - 2400	Down
	Mon. Aug. 25	0001 - 2400	Down
	Tue. Aug. 26	0001 - 2400	Up
	Wed. Aug. 27	0001 - 2400	Up
	Thur. Aug. 28	0001 - 0600	Up
Rolling Mill	Thur. Aug. 21	0600 - 1630	Up
		1800 - 2400	Down
	Fri. Aug. 22	0001 - 0455	Down
		0600 - 0930	Up
		1200 - 2400	Down
	Sat. Aug. 23	0001 - 0630	Down
		0930 - 1530	Up
		1830 - 2130	Down
	Sun. Aug. 24	0001 - 2400	Down
	Mon. Aug. 25	0001 - 0300	Down
		0300 - 1530	Up
		1800 - 2400	Down
	Tue. Aug. 26	0001 - 0630	Down
		0900 - 1530	Up
		1830 - 2400	Down
	Wed. Aug. 27	0001 - 0630	Down
		0900 - 1230	Up
		- 1530	Down
		- 1830	Up
		2130 - 2400	Down
	Thur. Aug. 28	0001 - 0600	Down

† *Times are based on sampling schedules. Each time a sample was collected, USSC personnel stated whether the process was up or down. This time period does not reflect accurately the time periods the processes were operational; however, it does provide the process status each time samples were collected.*

Table 3

PRODUCTION DATA[†]
USSC HOMESTEAD WHEEL AND AXLE PLANT
August 1975

Date	Product[††]					
	Wheel		Axle		Total	
	(m. ton)	(ton)	(m. ton)	(ton)	(m. ton)	(ton)
Thur. Aug. 21	403	444	40	44	443	488
Fri. Aug. 22	356	392	255	281	611	673
Sat. Aug. 23	208	229	160	176	368	405
Sun. Aug. 24	-	-	-	-	-	-
Mon. Aug. 25	423	466	-	-	423	466
Tue. Aug. 26	333	367	211	233	544	600
Wed. Aug. 27	389	429	250	276	639	705

† *Data provided by USSC in November 5, 1975, transmittal to S. R. Wassersug, Director, Enforcement Division, Region III, from James L. Hamilton, Manager, Environmental Control - Water.*

†† *Metric tons calculated from data (tons) provided by USSC.*

Table 4

PRODUCTION DATA†

USSC HOMESTEAD WHEEL AND AXLE PLANT
January-June 1975

Week ending	Production Per Operating Day††												Total Production*	
	Axle Production						Wheel Production†††							
	Maximum		Minimum		Average		Maximum		Minimum		Average		Average	
	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)
1-4	N.O.**	N.O.	N.O.	N.O.	N.O.	N.O.	103	113	291	321	218	240	218	240
1-11	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	262	289	352	388	297	327	297	327
1-18	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	53	58	53	58	53	58	53	58
1-25	70	77	250	276	167	184	135	149	324	357	254	280	421	464
2-1	78	86	281	310	151	167	40	44	322	355	239	263	390	430
2-8	149	164	287	316	211	233	46	51	336	370	256	282	467	515
2-15	74	82	270	298	202	223	103	114	308	340	229	253	431	476
2-22	155	171	240	265	208	229	188	207	344	379	264	291	472	520
3-1	78	86	307	338	231	255	34	37	378	417	284	313	515	568
3-8	151	166	286	315	204	225	200	221	339	374	268	296	472	521
3-15	56	62	292	322	168	185	235	259	319	352	267	294	435	479
3-22	59	65	265	292	169	186	245	270	301	332	270	298	439	484
3-29	74	82	261	288	192	212	130	143	307	339	230	254	422	466
4-5	94	104	311	343	239	263	197	217	346	382	254	280	493	543
4-12	58	64	288	317	202	223	246	271	322	355	281	310	483	533
4-19	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	281	310	307	338	294	324	294	324
4-26	69	76	282	311	177	195	208	229	296	326	259	285	436	480
5-3	111	122	300	331	200	221	241	266	394	434	343	378	543	599
5-10	5	6	220	243	112	123	47	52	317	349	231	255	343	378
5-17	63	69	280	309	171	189	231	255	369	407	307	339	478	528
5-24	135	149	236	260	186	205	190	209	369	407	308	340	494	545
5-31	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	115	127	395	436	297	327	297	327
6-7	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	249	275	346	382	299	330	299	330
6-14	35	39	248	273	145	160	128	141	348	384	268	296	413	456
6-21	13	14	332	366	147	162	239	263	349	385	309	341	456	503
6-28	0.9	1	123	136	63	69	122	135	374	412	281	310	344	379
Six Month Avg.	73	81	268	295	177	195	164	181	317	349	253	279	400	441

† *Data provided by USSC in November 5, 1975, transmittal to S. R. Wasserug, Director Enforcement Division, Region III, from James L. Hamilton, Manager Environmental Control - Water*

†† *Metric tons calculated from data (tons) provided by USSC*

††† *Includes rolled wheels and circular sections. Production for the six-month period was 79.5% rolled wheels and 20.5% circular sections.*

* *Total production calculated from USSC data*

** *Not Operating*

Product	Production							
	Average Daily				Daily Maximum			
	Aug. 21-28		Jan.-June		Aug. 21-28		Jan.-June	
	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)	(m.ton)	(ton)
Wheels	352	388	253	279†	423	466	395	436†
Axles	183	202	177	195	255	281	332	366
Total	504	556	400	441				

† *Includes rolled wheels and circular sections*

Based on the total production figures, the data indicate that the Wheel and Axle plant was operating at production levels about 25% greater than production levels during the first six months of 1975.

Water used at the plant is obtained from USSC's wells.* Water usage for the first six months of 1975 is tabulated below.**

Month	Total Water Pumped				Total Water Treated	
	(m^3/mo.)	(10^6gal/mo.)	(m^3/day)†	(mgd)†	(m^3/mo.)	(10^6gal/mo.)
Jan.	72,500	19.150	2,350	0.62	40,100	10.590
Feb.	109,600	28.960	3,900	1.03	66,900	17.670
Mar.	114,800	30.340	3,700	0.98	67,700	17.890
April	119,600	31.600	4,000	1.05	72,500	19.150
May	105,600	27.900	3,400	0.90	59,500	15.700
June	100,950	26.670	3,350	0.89	52,000	13.740

† *Calculated from number of days per month*

The well water pumped averaged about 3,450 m^3/day (0.91 mgd). During the survey, the total wastewater discharged averaged 8,790 m^3/day (2.32 mgd), or about 2.5 times the daily volume pumped during the first six months. Because USSC reports a total average daily waste flow of approximately 10,750 m^3 (2.8 X 10^6 gal), fresh water from the

* *Waste loads are computed on a gross basis*
** *Provided by USSC in response to the 308 Request*

municipality must also be used in the processes or for cooling purposes to make up the difference between pumped water and wastewater. Sanitary wastes, discharged to the Allegheny County Sanitary District, amount to 120 m^3/day (31,823 gpd); thus an additional 7,260 m^3/day (1.92 mgd) of fresh water must be used at the plant. However, total water supply is reported at 3,785 m^3/day (1 mgd). Therefore, it appears that the USSC method of determining water usage and wastewater volumes is not accurate or realistic.

The in-plant monitoring results are tabulated by individual sampling locatons and are summarized in Tables 5, 6, 7, 8, and 9. Self-monitoring data and monitoring frequency for the period January through June 1975 are summarized in Tables 10 and 11. Organic compounds were only found in the Graham Street sewer discharge to the Ohio River and are discussed in that section.

OUTFALL 018

According to USSC personnel, the discharge from the axle forge sector only contains cooling water. The analytical results show that the average daily TSS concentration for the seven-day period was <10 mg/l.* This indicates that suspended solids were not added to the cooling water from process operations. The oil/grease concentration over the same period averaged about 2 mg/l.

During the five days the axle forge sector was operational, the flow averaged 2,900 m^3/day (0.77 mgd). On the non-operating days,

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* *The detectable limit for TSS is 1 mg in 1 liter of water, by weight. The TSS level for distilled water blanks, using 100 ml samples, was less than 2 mg, which corresponds to a detectable concentration of <10 mg/l. Therefore, values of $\leq$10 mg/l TSS should be considered as no net increase in solids over background levels.*

Table 6

SUMMARY OF FIELD MEASUREMENTS AND TOTAL SUSPENDED SOLIDS
HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975†

Station Description	Date (August)	Flow (m³/day)	Flow (mgd)	pH Range (S.U.)	Temp. Range (°C)	Total Suspended Solids (mg/l)	Total Suspended Solids (kg/day)	Total Suspended Solids (lb/day)
Outfall 018	21-22	2,610	0.69††	7.2-7.9	18-24	10	26	58
	22-23	2,760	0.73††	6.8-7.7	22-25	< 10	< 28	< 61
	23-24	2,345	0.62	7.0-7.7	18-25	12	28	62
	24-25	1,970	0.52	6.9-7.4	15.5-17.5	12	24	52
	25-26	2,535	0.67	6.8-7.7	17-24	10	25	56
	26-27	3,030	0.80	6.9-7.5	22-24.5	< 10	< 30	< 67
	27-28	3,745	0.99	6.9-7.4	22.5-24.5	< 10	< 38	< 83
7-Day Average†††		2,725	0.72	6.8-7.9	17-25	< 10	< 28	< 62
Outfall 019	21-22	6,470	1.71	6.8-7.8	19-29	16	103	228
	22-23	6,395	1.69	7.0-8.0	21-28	< 10	< 64	< 141
	23-24	6,170	1.63	6.9-7.6	19-28.5	< 10	< 62	< 136
	24-25	5,225	1.38	6.9-7.5	17.5-20	10	52	115
	25-26	6,210	1.64	6.7-7.2	20.5-29.5	< 10	< 62	< 137
	26-27	6,210	1.64	6.5-7.5	20.5-30	23	143	315
	27-28	6,320	1.67	6.8-7.3	20-29	10	63	139
7-Day Average		6,140	1.62	6.5-8.0	17.5-30	< 13	: 78	< 173
Outfall 020	21-22	11	0.003	6.9-8.2	20-22	15	0.2	0.4
	22-23	8	0.0022	6.9-8.1	20-22.5	< 10	< 0.1	< 0.2
	23-24	4	0.0011	6.8-7.6	21-23	< 10	< 0.04	< 0.1
	24-25	0	0.0	-	-	-	-	-
	25-26	6	0.0016	6.8-7.7	21-27.5	16	0.1	0.2
	26-27	12	0.0032	7.0-7.4	21.5-22.5	< 10	< 0.12	< 0.3
	27-28	9	0.0024	7.0-7.4	19.5-20	< 10	< 0.1	< 0.2
7-Day Average		8	0.0023	6.8-8.2	19.5-27.5	< 12	< 0.1	< 0.2
Location 119	21-22	1,380	0.365	6.5-7.5	21.5-33	20	28	61
	22-23	1,530	0.405	6.6-7.2	22-31.5	< 10	< 15	< 34
	23-24	1,145	0.302	6.2-6.8	22-32	16	18	40
	24-25	220	0.058	6.2-6.8	19-21.5	29	6	14
	25-26	1,485	0.392	5.4-6.8	22-34	18	27	59
	26-27	1,310	0.346	6.2-7.2	22-34.5	< 10	< 13	< 29
	27-28	1,515	0.400	6.5-6.8	22-31.5	< 10	< 15	< 33
7-Day Average		1,225	0.324	5.4-7.5	19-34.5	< 14	< 17.5	< 38
Influent to Oil Treatment Plant From Wheel Mill	21-22	1,345	0.355	7.6-8.1	20-33.5	20	27	59
	22-23	1,415	0.374	7.4-8.0	22-31	14	20	44
	23-24	1,070	0.283	7.1-7.8	21-32.5	24	26	57
	24-25	220	0.058	6.9-7.6	19.5-22	22	5	11
	25-26	1,485	0.392	6.8-8.0	18-34	19	28	62
	26-27	1,260	0.333	7.0-7.9	21-34.5	23	29	64
	27-28	1,440	0.380	7.0-7.8	21-32	25	36	79
7-Day Average		1,175	0.311	6.8-8.1	18-34.5	21	24	54
Influent to Oil Treatment Plant From Axle Sector	21-22	37	0.0098	6.8-11.4	23.5-27	78	2.9	6.4
	22-23	115	0.0303	6.8-8.2	25-28	70	8.0	17.7
	23-24	69	0.0183	6.8-7.3	27-29	36	2.5	5.5
	24-25	0.4	0.0001	6.9	25	88	0.05	0.11
	25-26	0	0.0	-	-	-	-	-
	26-27	50	0.0132	6.8-7.2	24.5-28	50	2.5	5.5
	27-28	75	(0199	6.9-7.1	26.3-27	70	5.3	11.6
7-Day Average		58	0.0153	6.8-11.4	23.5-29	61	3.5	7.8
Graham Street†††† Sewer at Ohio River	21-22	Not Determined		6.9-8.3	19.5-26	21		
	22-23	Not Determined		6.6-7.6	21-26	< 10		
	23-24	Not Determined		6.9-7.9	19.5-26.5	< 10		
	24-25	Not Determined		6.8-7.2	17-19	-*		
	25-26	Not Determined		6.8-7.4	18.5-25.5	< 10		
	26-27	Not Determined		6.8-7.3	21-28	< 10		
	27-28	Not Determined		6.9-7.2	21-25	10		
7-Day Average				6.6-8.3	18.5-28	12**		
Graham Street Sewer Upstream of Outfall 018	26-27***	Not Determined		6.9	-	74		

† Sampling period 6 a.m. to 6 a.m. TSS composited on a flow-weighted basis.

†† Flow estimated because Manning flow recorder was inoperative for 6 hours on August 21 and 7 hours on August 22.

††† Seven-day average concentrations calculated on a flow-weighted basis.

†††† TSS composited on an equal volume basis.

* Sample not analysed

** Arithmetic average

*** Only date flow observed. Sample collected at 4:15 p.m.

Table 6

DAILY OIL AND GREASE CHARACTERISTICS
USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Date (August) (6 a.m.-6 a.m.)	Units	Outfall 018	Outfall 019	Outfall 020	Location 119	Influent to OTP† from Wheel Mill	Influent to OTP† from Axle Shop	Graham St. Sewer at Ohio River
21-22								
Flow	m^3/day	2610	6470	11	1380	1345	35	
Flow	mgd	0.69	1.71	0.003	0.365	0.355	0.0098	
Conc	mg/l	< 1.34	12	< 1	4	62	530	23
Load	kg/day	< 3.5	78	< 0.01	6	84	20	
Load	lb/day	< 7.7	171	< 0.03	13	185	43	
22-23								
Flow	m^3/day	2760	6395	8	1530	1415	115	
Flow	mgd	0.73	1.69	0.002	0.405	0.374	0.0303	
Conc	mg/l	< 1	9	< 3	3	88	470	< 1
Load	kg/day	< 2.8	54	< 0.02	3.8	125	54	
Load	lb/day	< 6.1	120	< 0.05	8.4	275	119	
23-24								
Flow	m^3/day	2345	6170	4	1145	1075	70	
Flow	mgd	0.62	1.63	0.0011	0.302	0.284	0.0183	
Conc	mg/l	< 5	8	< 2	15	121	533	5
Load	kg/day	10.6	49	< 0.006	16.9	130	37	
Load	lb/day	23.3	109	< 0.01	37	286	81	
24-25								
Flow	m^3/day	1970	5225	0	220	220	0.4	
Flow	mgd	0.52	1.38	0	0.058	0.058	0.0001	
Conc	mg/l	< 2	4	0	6	65	110	< 3
Load	kg/day	< 3.9	19	0	1.3	14	0.04	
Load	lb/day	< 8.7	42	0	2.9	31	0.09	
25-26								
Flow	m^3/day	2535	6210	6	1485	1485	0	
Flow	mgd	0.67	1.64	0.0016	0.392	0.392	0	
Conc	mg/l	< 1	24	< 1	5	131	0	5
Load	kg/day	< 2.5	149	< 0.006	7.4	194	0	
Load	lb/day	< 5.6	328	< 0.01	16.4	427	0	
26-27								
Flow	m^3/day	3030	6210	12	1310	1260	50	
Flow	mgd	0.80	1.64	0.0032	0.346	0.333	0.0132	
Conc	mg/l	< 4	10	< 1	8	108	575	7
Load	kg/day	< 12.1	60	< 0.01	10.1	136	29	
Load	lb/day	< 26.7	133	< 0.03	22.4	300	63	
27-28								
Flow	m^3/day	3745	6320	9	1515	1440	75	
Flow	mgd	0.99	1.67	0.0024	0.400	0.380	0.0199	
Conc	mg/l	< 1	4	< 1	5	133	380	7
Load	kg/day	< 3.8	25	< 0.009	7.1	191	29	
Load	lb/day	< 8.3	56	< 0.02	15.6	420	63	
7-Day Average								
Flow	m^3/day	2725	6140	8	1225	1175	58	
Flow	mgd	0.72	1.62	0.0023	0.324	0.311	0.0153	
Conc	mg/l	< 2	10	< 2	6	106	482	7 †††
Load	kg/day	< 5.6	62	< 0.01	7.5	125	28	
Load	lb/day	< 12.3	137	< 0.03	16.5	275	61	

† *Oil Treatment Plant*
†† *Flow-weighted average concentration*
††† *Arithmetic average concentration*

Table 7

GRAB SAMPLE ANALYSES (OIL AND GREASE,† PHENOL)

USSC HOMESTEAD WHEEL AND AXLE PLANT

August 21-28, 1975

Date Collected (August)	Sampling Location									Influent to Oil Treatment Plant From Wheel Mill		Influent to Oil Treatment Plant From Axle Shop		Graham Street Sewer at Ohio River	
	Outfall 018		Outfall 019		Outfall 020		Location 119								
	Time†† (hours)	O/G (mg/l)	Time (hours)	O/G (mg/l)	Time (hours)	O/G (mg/l)	Time (hours)	O/G (mg/l)	Phenol (µg/l)	Time (hours)	O/G (mg/l)	Time (hours)	O/G (mg/l)	Time (hours)	O/G (mg/l)
21	1425	< 1	1455	5	1505	< 1	1535†††	1	< 1	1445	78	1440	NF*	1520	11
21	2007	< 1	2125	25	2145	1	2205**	7	NA***	2100	79	2040	780	2230	4
22	0415	2	0505	6	0520	1	0545	5	< 1	0455	30	0430	280	0600	53
22	1505	< 1	1540	2	1550	5	1625	3	1	1530	113	1520	100	1610	< 1
22	2100	< 1	2145	15	2150	< 1	2250	2	2	2135	63	2115	840	2220	1
23	0610	< 1	0635	4	0645	< 1	0710	5	1	0630	62	0620	610	0704	2
23	1505	2	1535	9	1545	1	1619	16	1	1525	210	1520	460	1605	6
23	1810	14	1850	8	1900	2	1945	14	1	1840	140	1810	530	1920	4
24	0002	1	0030	11	0040	NF	0115	24	< 1	0025	71	0001	NF	0055	8
24	1500	< 1	1515	5	1530	NF	1535	NF	NF	1515	NF	1510	NF	1535	< 1
24	1655	2	1706	4	1835	NF	1900	NF	NF	1703	NF	1810	NF	1720	3
25	0255	3	0320	2	0335	NF	0400	6	1	0313	65	0300	110	0350	4
25	1403	< 1	1423	39	1430	< 1	1455	9	1	1412	200	1408	NF	1445	3
25	2100	< 1	2120	9	2125	NF	2200	1	1	2110	61	2100	NF	2145	6
26	1300	< 1	1335	7	1345	< 1	1415	7	8	1325	260	1315	1060	1400	10
26	1805	6	1830	12	1840	NF	1920	3	6	1821	77	1810	440	1905	7
26	2100	4	2130	9	2135	NF	2205	7	5	2120	53	2100	92	2150	5
27	0300	5	0330	11	0330	NF	0405	14	5	0320	42	0303	710	0350	6
27	1500	1	1530	4	1545	1	1625	2	5	1525	140	1513	150	1610	11
27	1800	< 1	1830	5	1835	NF	1915	6	5	1825	210	1805	370	1855	7
28	0303	< 1	0330	3	0350	< 1	0403	6	4	0315	48	0305	620	0400	2

† *All oil/grease samples corrected for blank value of 3 mg/l*

†† *Time sample was collected*

††† *Phenol sample collected at 1555 on August 21*

* *NF = No Flow*

** *Phenol sample collected at 0025 on August 22*

*** *Phenol sample not analyzed because bottle was broken in shipment from Pittsburgh to Denver*

Table 8

INSTANTANEOUS OIL AND GREASE LOADS
OUTFALL 019 and LOCATION 119

USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Date (Aug.)	Outfall 019						Location 119					
	Time Collected (hr)	Instantaneous Flow (m^3/day)	Instantaneous Flow (mgd)	O/G (mg/l)	O/G (kg/day)	O/G (lb/day)	Time Collected (hr)	Instantaneous Flow (m^3/day)	Instantaneous Flow (mgd)	O/G (mg/l)	O/G (kg/day)	O/G (lb/day)
21	1455	6,170	1.63	5	31	68	1535	2,505	0.662	1	2.5	5
	2125	7,570	2.0	25	189	417	2205	820	0.216	7	5.7	13
22	0505	6,700	1.77	6	40	89	0545	820	0.216	5	4	9
	1540	5,980	1.58	2	12	26	1625	2,725	0.720	3	8	18
	2145	5,940	1.57	15	89	196	2250	820	0.216	2	1.6	4
23	0635	6,170	1.63	4	25	54	0710	820	0.216	5	4	9
	1535	6,055	1.60	9	54	120	1619	820	0.216	16	13	29
	1850	6,170	1.63	8	49	109	1945	545	0.144	14	7.6	17
24	0030	6,245	1.65	11	69	151	0115	545	0.144	24	13	29
	1515	4,960	1.31	5	25	55	1535	0	0	NF	-	-
	1706	4,805	1.27	4	19	42	1900	0	0	NF	-	-
25	0320	5,600	1.48	2	11	25	0400	435	0.115	6	2.6	6
	1423	6,740	1.78	39	263	580	1455	2,190	0.576	9	20	43
	2120	6,890	1.82	9	62	137	2200	545	0.144	1	0.5	1
26	1335	6,245	1.65	7	44	96	1415	2,725	0.720	7	19	42
	1830	5,715	1.51	12	69	151	1920	1,090	0.288	3	3	7
	2130	6,055	1.60	9	54	120	2205	1,090	0.288	7	7.6	17
27	0330	5,790	1.53	11	64	140	0405	820	0.216	14	11	25
	1530	6,020	1.59	4	24	53	1625	2,045	0.540	2	4	9
	1830	6,740	1.78	5	34	74	1915	820	0.216	6	5	11
28	0330	7,570	2.00	3	23	50	0403	820	0.216	6	5	11
Arithmetic Average		6,195	1.64	9	59	131		1,210	0.319	7	7.3	16

Table 9

SUMMARY OF METALS ANALYSES

USSC HOMESTEAD WHEEL AND AXLE PLANT

August 21-28, 1975

Station Description	Date (August)	Total Iron			Dissolved Iron			Total Chromium†	Al	Lead			Tin		
		(mg/l)	(kg/day)	(lb/day)	(mg/l)	(kg/day)	(lb/day)	(mg/l)	(mg/l)	(mg/l)	(kg/day)	(lb/day)	(mg/l)	(kg/day)	(lb/day)
Outfall 018	21-22	0.14	0.37	0.81	0.08	0.21	0.46	< 0.01††	< 0.2	0.07	0.18	0.40	< 0.5		
	22-23	0.17	0.47	1.04	0.08	0.22	0.49	< 0.01	< 0.2	0.05	0.14	0.30	< 0.5		
	23-24	0.04	0.09	0.21	0.04	0.09	0.21	< 0.01	< 0.2	0.05	0.12	0.26	< 0.5		
	24-25	0.08	0.16	0.35	0.04	0.08	0.17	< 0.01	< 0.2	0.05	0.10	0.22	< 0.5		
	25-26	0.18	0.46	1.01	0.05	0.13	0.28	< 0.01	< 0.2	< 0.05			< 0.5		
	26-27	0.15	0.45	1.00	0.03	0.09	0.20	< 0.01	< 0.2	< 0.05			< 0.5		
	27-28	0.18	0.68	1.49	0.04	0.15	0.33	< 0.01	< 0.2	< 0.05			0.9	3.4	7.4
	7-Day Avg.*	0.14	0.38	0.84	0.05	0.14	0.31	< 0.01	< 0.2	0.03	0.08	0.17	0.13	0.5	1.1
Outfall 019	21-22	1.03	6.7	14.7	0.10	0.65	1.43	< 0.01	< 0.2	0.06	0.388	0.86	< 0.5		
	22-23	0.83	5.3	11.7	0.08	0.51	1.13	< 0.01	< 0.2	< 0.05			1.2	7.7	16.9
	23-24	1.07	6.6	14.5	0.08	0.49	1.09	< 0.01	< 0.2	< 0.05			< 0.5		
	24-25	0.71	3.7	8.2	0.13	0.68	1.50	< 0.01	< 0.2	< 0.05			< 0.5		
	25-26	1.02	6.3	14.0	0.19	1.18	2.60	< 0.01	< 0.2	< 0.05			< 0.5		
	26-27	1.41	8.8	19.3	0.12	0.75	1.64	< 0.01	< 0.2	0.11	0.683	1.51	< 0.5		
	27-28	1.07	6.8	14.9	0.12	0.76	1.67	< 0.01	< 0.2	< 0.05			< 0.5		
	7-Day Avg.	1.03	6.3	13.9	0.12	0.72	1.58	< 0.01	< 0.2	0.03	0.15	0.34	0.18	1.1	2.4
Graham Street Sewer at River	21-22	1.25			0.15			< 0.01	< 0.2	< 0.05			< 0.5		
	22-23	0.79			0.07			< 0.01	< 0.2	< 0.05			< 0.5		
	23-24	0.64			0.06			< 0.01	< 0.2	< 0.05			< 0.5		
	24-25	0.41			0.06			< 0.01	< 0.2	< 0.05			0.5		
	25-26	0.82			0.10			< 0.01	< 0.2	< 0.05			< 0.5		
	26-27	1.13			0.08			< 0.01	< 0.2	< 0.05			< 0.5		
	27-28	0.67			0.09			< 0.01	< 0.2	< 0.05			< 0.5		
	7-Day Avg.**	0.82			0.09			< 0.01	< 0.2	< 0.05			< 0.5		

† *All hexavalent chromium less than total chromium values*

†† *All values with < (less than) sign considered as zero*

* *Flow-weighted average*

** *Arithmetic average*

Table 10

SUMMARY OF SELF-MONITORING DATA†

USSC HOMESTEAD WHEEL AND AXLE PLANT

January-June, 1975

Month	pH Range (S.U.)	Temp. Range (°C)	TSS Range (mg/l)	O/G Range (mg/l)	Phenol Range (mg/l)	CN_T Range (mg/l)	CN_A Range (mg/l)	TOC Range (mg/l)
				OUTFALL 018				
January								
February								
March	6.0	21.1			0.030	0.014	0.002	
April			7	0.1-22.1	0.022-0.036	0.006-0.017	0.00-0.010	10.4-17.8
May	6.8-7.0	23.9-24.4	7	1.4-2.7	0.037	0.002	0.000	21.6
June	6.5	16.7						
				OUTFALL 019				
January			2.4	11.5-13.6				
February	7.2	23						
March		20	4-17	4.3-43.5	0.014-0.024	0.003-0.014	0.000-0.012	7.1-56.7
April		21-27		1.7-43.7	0.02-0.158	0.006-0.037	0.00-0.023	6.7-19.8
May	7.0	20.6						
				LOCATION 119				
January	5.8-7.4	27	24	11.5-18				
February	6.7-7.05	19-29	20	10.2-31.8				
March		20			0.03-0.204	0.003-0.273	0.000-0.251	2.4-56.7
April		19-20.6		4-12.7	0.04-0.064	0.008	0.00	221
May	6.4-6.5	30.6-32.2	14	10.2-16.2	0.042	0.001		19.4
June	6.8	20.6						
				OUTFALL 020				
January								
February								
March			70-156	24.4-72.9	0.022-0.026	0.026-0.030	0.000-0.014	16.1
April			9-26	1.7-42.2	0.018-0.058	0.009	0.000	8.2-21.1
May	6.7-6.9	15-15.6	13	1.8-43.2	0.028	0.001	0.000	21.9
June	7.0	16.1						

† *Single data value indicates only one sample analyzed.*

Table 11

MONITORING SCHEDULE†
USSC HOMESTEAD WHEEL AND AXLE PLANT

Outfall	Effluent Parameter	Monitoring Frequency	Sample Type
018	Flow	1/quarter	measured
	Temperature	1/quarter	"i-s"
	pH	1/quarter	grab
019	Flow	1/month	measured
	Temperature	1/month	"i-s"
	pH	1/month	grab
	TSS	1/month	24-hour composite
	Oil/grease	1/month	3 grab/ 24 hours
020	None		
(location) 119	None		

† *Minimum monitoring required by NPDES Permit*

Sunday and Monday, the flows decreased to 1,970 m^3/day (0.52 mgd) and 2,535 m^3/day (0.67 mgd) respectively. The TSS and oil/grease concentrations were similar to the concentrations found on the other five days. The NEIC results indicate that TSS is not significant in this outfall. However, one oil/grease concentration of 14 mg/l indicates that oils or lubricants may be discharged through this outfall.

The effluent was analyzed for various metals which could possibly be present. The data [Table 9] shows that metal concentrations were insignificant in this outfall.

Self-monitoring data were available from USSC for March through June 1975.* Flows were not included in the data sheets, thus loads could not be compared with the NEIC monitoring data. TSS concentrations were equivalent to concentrations found in August 22-28. Oil/grease concentrations ranged from 0.1 to 22 mg/l, again indicating that oils or lubricants may be discharged from this outfall. NEIC did not monitor for phenol, cyanide, or total organic carbon (TOC); USSC data indicate these constituents are insignificant.

The waste loads discharged per unit production** are summarized in Table 12. Over the seven-day monitoring period the TSS and oil/grease loads discharged were less than 0.06 kg/1,000 kg (0.11 lb/ton) and less than 0.01 kg/1,000 kg (0.02 lb/ton) of production, respectively.

In response to the 308 Request, USSC provided drawing no. BB-7410, showing the API*** separator in the axle forge sector; dimensions were not given on the drawing. NEIC personnel estimated the dimensions

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* *USSC response to the 308 Request, August 11, 1975*

** *Sampling occurred between 6 a.m. and 6 a.m. for each 24-hour period while total production reported by USSC was for the period of 12 midnight to 12 midnight. Therefore, waste loads per unit production are only approximate values.*

*** *American Petroleum Institute.*

Table 12

SUMMARY OF WASTE LOADS PER UNIT PRODUCTION†
USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Date (Aug.)	Total Production (m.ton)	(ton)	Outfall 018 TSS (kg/1000 kg)	(lb/ton)	Outfall 018 O/G (kg/1000 kg)	(lb/ton)	Outfall 019 TSS (kg/1000 kg)	(lb/ton)	Outfall 019 O/G (kg/1000 kg)	(lb/ton)	Location 119 TSS (kg/1000 kg)	(lb/ton)	Location 119 O/G (kg/1000 kg)	(lb/ton)
21-22	443	488	0.06	0.12	<0.01	<0.02	0.23	0.47	0.18	0.35	0.06	0.13	0.01	0.03
22-23	611	673	<0.05	<0.09	<0.01	<0.01	<0.10	<0.21	0.09	0.18	<0.02	<0.05	0.01	0.01
23-24	368	405	0.08	0.15	0.03	0.06	<0.17	<0.34	0.13	0.27	0.05	0.10	0.05	0.09
24-25	0	0	-	-	-	-	-	-	-	-	-	-	-	-
25-26	423	466	0.06	0.12	<0.01	<0.01	<0.15	<0.29	0.35	0.70	0.06	0.13	0.02	0.04
26-27	544	600	<0.06	<0.11	<0.02	<0.04	0.26	0.53	0.11	0.22	<0.02	<0.05	0.02	0.04
27-28	639	705	<0.06	<0.12	<0.01	<0.01	0.10	0.20	0.04	0.08	<0.02	<0.05	0.01	0.02
7-day Average	504	556	<0.06	<0.11	<0.01	<0.02	<0.15	<0.31	0.12	0.25	<0.03	<0.07	<0.01	<0.03

† *Sampling occurred between 6 a.m. and 6 a.m. for each 24-hour period while total production reported by USSC was for the period of 12 midnight to 12 midnight. Therefore, waste loads per unit production are only approximate values.*

to be 1-1/4 m wide x 4-1/4 m long x 1-1/4 m deep (4 ft x 14 ft x 4 ft). The heavy oil is reclaimed and the underflow is sent to the waste oil treatment plant. According to the drawing, 132 l/min (35 gpm) of wastewater flows to the waste oil treatment plant and the separated oil flows to the recovered oil storage tank. NEIC monitoring results show that the flow to the waste oil treatment facility averaged about 40 l/min (11 gpm) and contained approximately 60 mg/l TSS and 480 mg/l oil/grease.

USSC has not proposed effluent limitations for this outfall in their adjudicatory hearing request.

The sampling location selected by USSC for monitoring this outfall is satisfactory. Flows are not measured by USSC at this location. However, conventional flow measuring devices can be installed in the manhole.

OUTFALLS 019 AND 119

In their adjudicatory hearing request, USSC proposed that another location be designated for monitoring outfall 019, and proposed that the effluent from the waste oil treatment plant be designated as outfall 119 and be monitored for TSS and oil/grease.

According to USSC, outfall 019 receives untreated cooling water, untreated water from the power house, and the effluent from the oil treatment facility. The seven-day average flow through outfall 019, measured by NEIC, was 6,140 m^3/day (1.62 mgd); the flow from the waste oil treatment plant comprised about 20% of this flow. Monitoring results show that the effluent from the oil treatment facility averaged

approximately 14 mg/l TSS. Over the same period, the TSS concentration discharged through outfall 019 averaged 13 mg/l. The TSS levels were equivalent at both monitoring points and approached the detectable limit.

On a flow-weighted basis [Table 6], the oil/grease concentrations in discharges 019 and 119 averaged 10 and 6 mg/l respectively. On an arithmetic, non-flow-weighted basis, the corresponding oil/grease concentrations were 9 and 7 mg/l respectively [Table 8]. Therefore, it would appear that the location for monitoring oil/grease and TSS could be either outfall 019 or 119. However, daily waste loads must be calculated from the flow measured at outfall 019. The average instantaneous oil/grease load for the seven days discharged through outfall 019 was 59 kg/day (131 lb/day) while the load discharged through location 119 was 7 kg/day (16 lb/day). Although the flow contributed by location 119 was 20% of the total flow through outfall 019, the waste load discharged from outfall 119 was only 12% of the total oil/grease load. Calculating the oil/grease load from concentrations found in location 119 and the flow through outfall 019 results in an oil/grease load approximately 25% less than the load actually discharged. Since outfall 019 contains waste streams from all sources while location 119 does not, representative samples can only be collected at outfall 019; flows should also be measured at outfall 019 to provide accurate data on waste loads.

In their adjudicatory hearing request, USSC has proposed that the TSS and oil/grease loads be established at the levels listed below for location 119 for the entire life of the NPDES permit. Concentration limits were listed as *not applicable* (N/A).

Parameter	Daily Average		Daily Maximum	
	(kg/day)	(lb/day)	(kg/day)	(lb/day)
TSS	423	930	1,269	2,790
O/G	236	520	708	1,560

Using the proposed limitations for location 119 and the total average daily flow from outfall 019 of 6,140 m^3/day (1.62 mgd), the average oil/grease concentration would be about 40 mg/l and the maximum concentration would be 115 mg/l. The average concentrations for the seven-day period for both outfalls were 10 mg/l (019) and 7 mg/l (119) while the maximum concentrations were 39 mg/l (019) and 24 mg/l (119).

The proposed limitations would allow waste loads approximately 25 times greater than the daily average TSS load and 32 times greater than the daily average oil/grease load discharged through location 119 during NEIC monitoring. If these proposed limitations were applied to outfall 019, the waste loads would be 5 times and 4 times greater than, respectively, the actual TSS and oil/grease loads discharged.

On a unit production basis, the average waste loads discharged are compared below with the proposed limitations, based on the production for August 21-28.

Parameter	Daily Average Waste Load					
			Actual (Aug. 21-28)			
	USSC Proposed		Outfall 019		Location 119	
	(kg/1,000 kg)	(lb/ton)	(kg/1,000 kg)	(lb/ton)	(kg/1,000 kg)	(lb/ton)
TSS	0.84	1.67	0.15	0.31	0.03	0.07
O/G	0.47	0.94	0.12	0.25	0.01	0.03

Clearly, the proposed limitations do not reflect actual conditions at either monitoring point, even at the high production levels experienced during the survey.

Total and dissolved iron concentrations were higher in this discharge than those concentrations found in outfall 018, which contains only cooling water and thus would reflect background conditions.

However, the higher concentrations were not significant. Chromium, aluminum, lead, and tin concentrations were equivalent to the levels found in the cooling water (e.g. outfall 018 concentrations).

Self-monitoring data provided by USSC for January through June 1975 did not include flows; therefore, loads could not be determined. Concentrations reported for TSS and oil/grease were equivalent to those found August 21-28. Additional parameters monitored by USSC, cyanide, phenols, and TOC were not present at significant levels.

The sampling location selected by USSC for monitoring outfall 019 is satisfactory. However, if the steel plate covering the pit remains in place during monitoring, flows cannot be measured. Moreover, the 28 cm (11 in) square opening in the plate limits the access for representative sample collection. Foreign material could be introduced into the sample from the pit's walls, resulting in erroneous data. Flows through this outfall are not measured by USSC.

OUTFALL 020

USSC withdrew their application to discharge wastewater through this outfall. However, water from quenching operations in the machine shop is discharged through this outfall. The fresh water valve controlling the inflow to the quenching tank was open only for the 8 a.m. to 4 p.m. turn. The TSS concentrations were at the detectable levels and oil/grease concentrations were not significant. The flow averaged about 8 m^3/day (2,300 gpd). The discharge was essentially fresh water.

Self-monitoring data for March through May show solids and oil/grease concentrations much greater than those found during the NEIC survey. Survey concentrations were about 10 mg/l TSS and 1 mg/l oil/grease. The TSS concentrations reported by USSC ranged from 9 to 156 mg/l. Oil/grease concentrations ranged from 2 to 73 mg/l. NEIC

personnel observed that quenching operations were not being conducted whenever samples were collected. However, self-monitoring results reported by USSC indicate that solids and oil/grease constituents are discharged from quenching operations. The Company does not measure flows through this outfall.

Access to the outfall is a pit, usually covered with a steel plate, inside the machine shop. A 28 cm (11 in) square opening has been cut in the plate for monitoring. Flow measurement is not possible without removing the steel plate and representative samples cannot be collected through the 28 cm square opening because direct access to the waste stream is not possible. Complete access to the outfall pipe can only be achieved with the cover removed.

USSC has not proposed limitations for this outfall.

GRAHAM STREET SEWER

USSC is not required to monitor the effluent discharged from the Graham Street storm sewer into the Ohio River. NEIC personnel monitored the discharge at the river and the wastewater flowing in the storm sewer upstream of the outfall 018 connection, to determine if USSC had additional connections to the storm sewer. Flows were not determined at either location. The upstream location was dry except on one occasion (discussed previously) when there was a heavy rain. Based on concentrations found in the wastewaters discharged to the Ohio River, it appears that there are no additional connections from the Wheel and Axle Plant to the storm sewer. USSC personnel have stated that there are no additional connections to the storm sewer.

Grab samples were collected twice during the survey for analysis for organic compounds. Petroleum hydrocarbons, primarily normal paraffins, were found at low levels in the sample collected from the Graham Street

sewer discharge to the Ohio River on August 25. These hydrocarbons ranged from C_9 to C_{20} and appeared in a uniform pattern suggesting light-weight refined oils [Table 13]. Since these compounds were not present in the discharges from the Wheel and Axle Plant, they must originate from sources downsewer of the USSC facility.

EVALUATION OF WASTE OIL TREATMENT FACILITY

To evaluate the efficiency of the oil treatment facility, the two influent waste streams and the effluent waste stream were sampled for TSS and oil/grease [Fig. 2]. Due to the fluctuations in the effluent flow measuring device discussed in Appendix B, the treatment efficiency can only be approximated. Influent and effluent waste loads were calculated based on the daily flow [Table 14]. The treatment process removed approximately 95% of the influent oil/grease load over the seven-day period. Suspended solids removal averaged about 38% because the pH of the effluent ranged between 5.4 to 7.5. A higher percentage solids removal could be achieved if the pH were adjusted to the 8 to 8.5 range after the oil/grease had been removed. However, the effluent TSS concentration averaged <14 mg/l with a maximum concentration of 29 mg/l; therefore, additional solids recovery is not warranted.

During the reconnaissance, USSC personnel stated that all wastewater from the wheel mill flows to the oil treatment facility where it is treated with the axle forge sector API separator underflow. Drawing no. BB-7410 shows an intermittent flow containing up to 100,000 ppm oil from a sonic tester sump to the wheel rolling mill flume. From this flume, 1,890 l/min (500 gpm) of wastewater containing 200 ppm oil and 100 ppm TSS is pretreated in the wheel mill separator before discharge to the oil treatment facility [Fig. 3]. USSC personnel did not discuss

Table 13

SUMMARY OF ORGANIC COMPOUNDS
USSC WHEEL AND AXLE PLANT (GRAHAM STREET SEWER)
August 25, 1975

Compound	Concentration (µg/l)
C_9 - Nonane	Trace
C_{10} - Decane	3
C_{11} - Undecane	3
C_{12} - Dodecane	8
C_{13} - Tridecane	10
C_{14} - Tetradecane	17
C_{15} - Pentadecane	15
C_{16} - Hexadecane	15
C_{17} - Heptadecane	14
C_{18} - Octadecane	10
C_{19} - Nonadecane	8
C_{20} - Eicosane	3

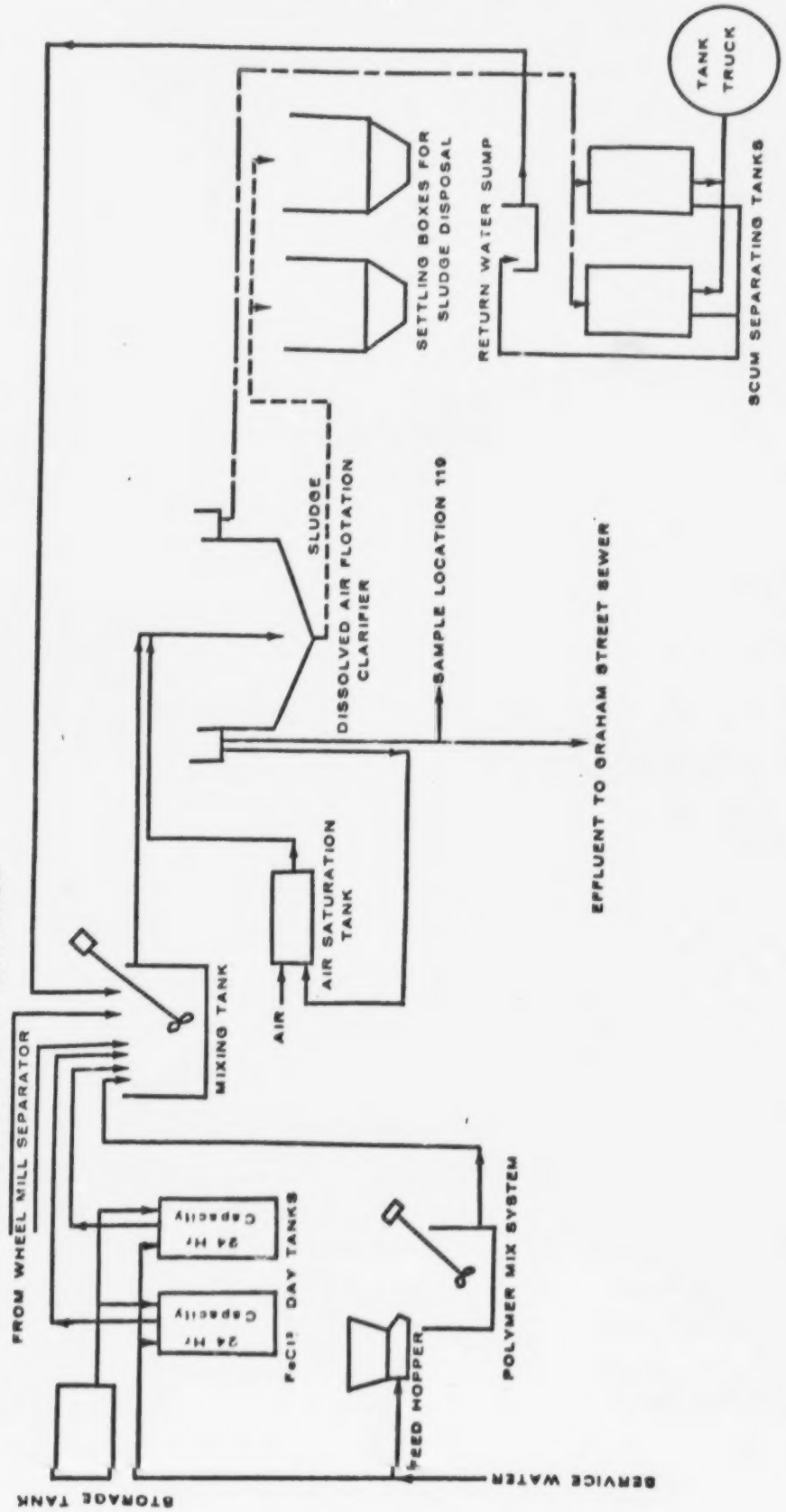

Figure 2. Wastewater Treatment Facility Flow Diagram, Homestead Wheel and Axle Works
(From USSC Drawing No 88-7410)

Table 14

WASTE OIL TREATMENT PLANT EVALUATION †

USSC HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Date (Aug.)	Combined Influent†† TSS (mg/l)	TSS (kg/day)	O/G (mg/l)	O/G (kg/day)	Effluent TSS (mg/l)	TSS (kg/day)	O/G (mg/l)	O/G (kg/day)	Treatment Efficiency††† % Removal (TSS)	(O/G)
21-22	22	30	75	104	20	28	4.3	6	7	94
22-23	18	28	117	179	10	15	2.5	3.8	46	98
23-24	25	28	146	167	16	18	14.8	16.9	36	90
24-25	22	5	65	14	29	6	6	1.3	0	91
25-26	19	28	131	194	18	27	5	7.4	4	96
26-27	24	31	126	165	10	13	7.8	10.1	58	94
27-28	27	41	145	220	10	15	4.7	7.1	63	97
7-Day Average	22	28	125	153	14	17.5	6.1	7.5	38	95

† *Flows are presented in Table 6*
†† *Influent from Axle Forge Sector and from Wheel Mill*
††† *Based on load*

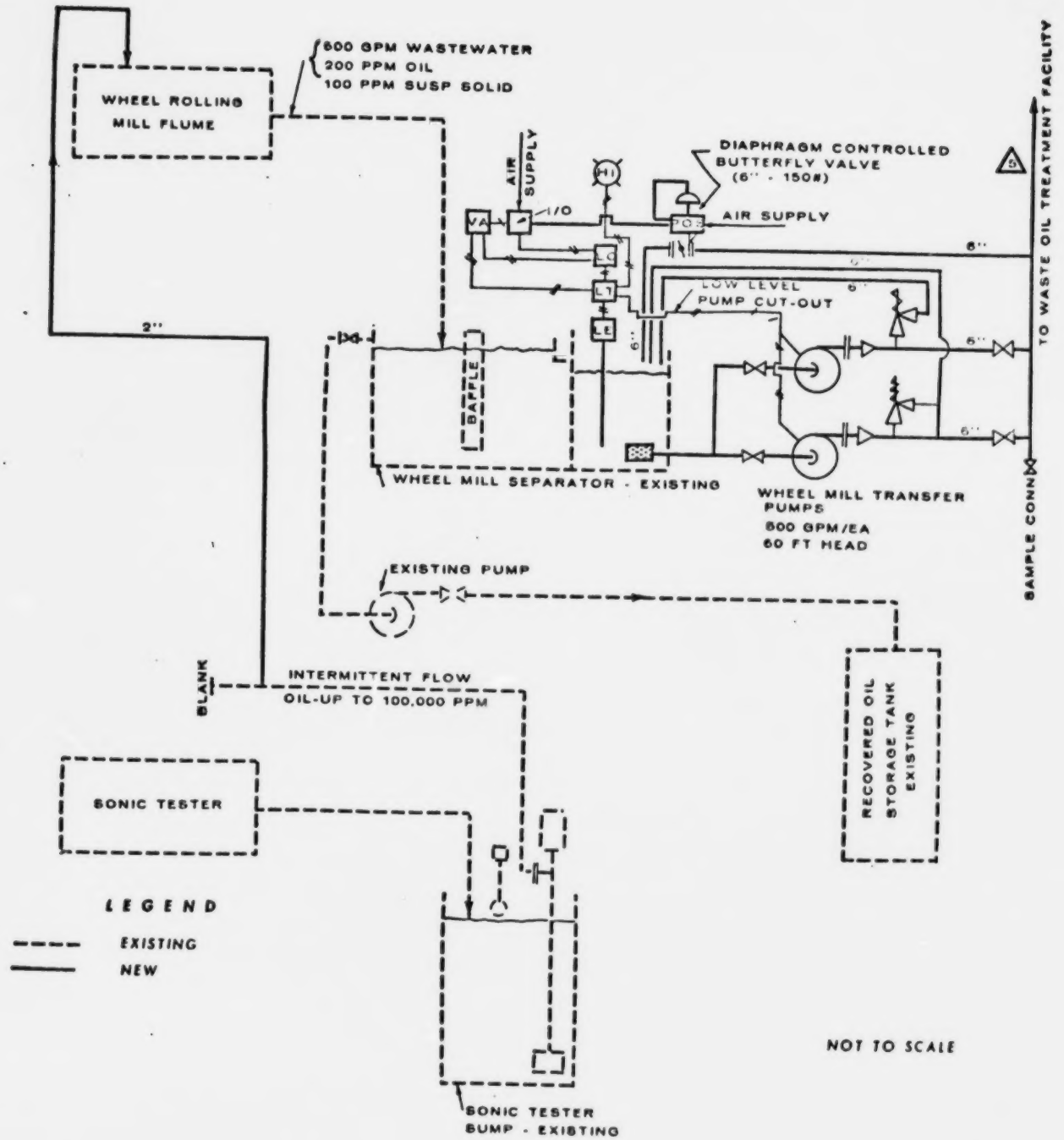

Figure 3. Wheel Mill Separator (from USSC Drawing No. 88-7410)

this separator during the reconnaissance or the survey; therefore, it is unknown by NEIC personnel if all waste oil is directed to the oil treatment facility.

Survey data show that the flow from this separator averaged about 815 l/min (215 gpm) and contained about 100 mg/l oil/grease and 20 mg/l TSS.*

Chemicals used in the treatment plant, according to USSC's response to the 308 Request, average about 2-1/4 kg (5 lb)/day of Betz No. 3320 polymer mixed with 330 l (88 gal) of ferric chloride and 2,670 l (712 gal) of water. The average flow during operating periods is 1,890 l/min (500 gpm). Average flow from the oil treatment plant, indicated by the flow indicator, averaged only 850 l/min (225 gpm) during the survey, even though the mill was operating at high production levels. During the reconnaissance, the flow indicator read 1,630 l/min (430 gpm).

The treatment plant operator informed NEIC personnel on July 17, 1975 that the influent and effluent to the treatment plant are sampled every 2 hours to rate treatment efficiency in terms of TSS and oil/grease removals. The operator stated that the plant was achieving waste removals somewhat less than 90% for both parameters and the system was less effective in soluble oil removal compared to non-soluble oil removal. The operator also stated that influent samples are collected at a number of points in the axle and wheel process operations and that approximately 90-95% of the influent is sampled. In response to the 308 Request question on treatment efficiency and data, USSC stated that the "efficiency of the waste water treatment facility for oil, turbidity and TSS is unknown. Plant records are only kept on the effluents from the

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* *Assuming that the sampling location designated by USSC contained the effluent from the wheel mill API separator and no other wastestream.*

plant and are reported on the monthly NPDES forms which are already in your possession. Separate data on removal of soluble vs. non-soluble oils is not available." Data on the soluble and non-soluble oil removals have apparently been collected by USSC but have not been reported to EPA.

V. MONITORING REQUIREMENTS

Recommended monitoring requirements for outfalls 018, 019 and 020 are tabulated in Table 15. The rationale is discussed below.

Outfall 018 - The NEIC survey data and self-monitoring data indicate that only cooling water is discharged, precluding the necessity for flow determinations. Equal volume composite samples, collected over a 24-hour period, will provide data on TSS concentrations. Individual aliquots should be collected at least every 3 hours when the axle forge sector is operating. Three oil/grease grab samples, collected over the same 24-hour period, are needed to determine if cooling water is being contaminated from sources within the axle forge sector. Since the cooling water is recycled within the area from a sump, there is a possibility that oils or lubricants could enter the system through floor drains. Oil/grease concentrations ranged up to 22 mg/l in the self-monitoring data for January through June 1975. Temperature and pH should be monitored each time a sample is collected. Because the flow is estimated, concentration rather than load limitations should be required for TSS and oil/grease. At flows of approximately 2,725 m^3/day (0.72 mgd), the minimum monitoring frequency should be once per month.*

Outfall 019 - All monitoring should be conducted at this outfall rather than the USSC proposed location 119, as all waste streams flow through the outfall. Because oil/grease concentrations exceed 10 mg/l, frequent monitoring of this parameter is necessary to determine

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* *Permit Program Guidance for Self-Monitoring and Reporting Requirements, Office of Permit Programs, U.S.E.P.A., Washington, D. C., April 30, 1973, page 12.*

Table 15

RECOMMENDED MONITORING REQUIREMENTS

USSC HOMESTEAD WHEEL AND AXLE PLANT
OUTFALLS 018, 019, 020

Effluent Parameter	Measurement Frequency	Sample Type
Outfall 018		
TSS	1/month	Equal volume composite
O/G	1/month	3 grab samples/24 hours
pH	1/month	Grab sample
Temperature	1/month	Grab sample
Flow	1/month	Estimated
Outfall 019		
TSS	1/week	Flow-weighted composite
O/G	1/week	3 grab samples/24 hours
pH	1/week	Grab sample
Temperature	1/week	Grab sample
Flow	Daily	Measured continuously
Outfall 020		
TSS	1/month	Equal volume composite
O/G	1/month	2 grab samples/8 hours
pH	1/month	Grab sample
Temperature	1/month	Grab sample
Flow	1/month	Estimated

compliance. The flow averaged 5,675 m^3/day (1.5 mgd); therefore the minimum monitoring frequency should be once per week.* Waste load limitations should be established for oil/grease and TSS parameters. Flow measurement will be necessary to determine these waste loads. Temperature and pH should be measured each time samples are collected.

Outfall 020 - The minor flow through this outfall does not warrant frequent monitoring. If uncontaminated cooling water were discharged, the only parameters required for monitoring would be pH and temperature. However, the self-monitoring results show that high concentrations of oil/grease and TSS were present in the discharge; thus, monitoring should also include these parameters. Monitoring must be done only when the machine shop is operating. Flow measurement is not necessary at present operating conditions, allowing concentration limitations to be established.

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* *Permit Program Guidance for Self-Monitoring and Reporting Requirements, Office of Permit Programs, U.S.E.P.A., Washington, D. C., April 30, 1973, page 12.*

Appendix A

Homestead Works Reconnaissance

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL FIELD INVESTIGATIONS CENTER– DENVER
BUILDING 53, BOX 25227, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

O : T. P. Gallagher, Director, NEIC- Denver DATE: July 23, 1975

ROM : E. J. Struzeski, Jr.
Industrial Waste Consultant

UBJECT: Inspection of U. S. Steel Corporation Homestead Works, Wheel and Axle Plant, McKees Rocks, Pennsylvania

Date of Inspection/Visit: July 17, 1975

Attendees: NEIC-Denver - Barrett Benson
Jim Pennington
Ed Struzeski, Jr.

EPA, Region III - Matt Miller
Pete Schaul

State of Pa. Pittsburgh Office - Bob Shilcosky

USSC - Dick McCarthy, Chief Environmental Officer, Homestead Works
Bob Dunham, Corporate, Pittsburgh
S. A. (Jeff) Davis, Corporate, Pittsburgh

Minimal field data were obtainable from USSC concerning the Homestead Works. The inspection team relied heavily on support data given previously with the permit.

Background on Wheel and Axle Plant, McKees Rocks, Pa.

The wheel and axle plant is involved in the manufacture of and finished steel products, specifically the production of forged steel railroad car axles and rolled railroad car wheels. The McKees Rocks installation consists of an "older" manufacturing area containing the permitted discharges; and a "newer" area north of the first, containing mostly dry operations, i.e. machine tool manufacturing, etc. The 1971 permit application of USSC defines three Outfalls; 018, 019 and 020. The 018 Outfall was said to comprise overflow waters from an oil separation tank serving a sump in the axle forge sector. The 019 discharge was described as overflow from a settling tank used for oil and solids separation following a rolling mill. This overflow is combined with cooling waters. The 020 Outfall was described

as water from the axle finishing and machine shop area combined with storm water. The official record stipulates that USSC withdrew their permit application for Outfall 020. However, we found on July 17 that this Outfall is once again flowing, presumably now an illegal discharge. Subsequent information for the wheel and axle plant shows that changes have taken place since 1971 including installation of an oil treatment plant for sewer 019 wastes.

The EPA Fact Sheet on the mid-1974 draft permit for the Homestead Works describes Outfalls 018 to 020 as follows:

Outfall 018 cooling water flows from axle forge furnaces, are not treated. Process flows of 0.05 MGD from the axle forge sector are directed to the treatment facilities on the 019 sewer. Cooling flows from the axle forge area of 0.64 MGD are released via the 018 Outfall. The 019 Outfall, as per the Fact Sheet, was said to receive 0.94 MGD power house effluent (untreated) plus 0.52 MGD cooling waters from the wheel rolling mill (untreated), plus 0.77 MGD from the new oil treatment facility for a total of 2.23 MGD. Influent to the oil treatment plant was made up of 0.72 MGD process waters from the wheel mill plus 0.05 MGD process oil separator overflow from the axle manufacturing area. Outfall 020, serving machine shop(s) was shown to have a flow of 0 MGD and this outfall was withdrawn by USSC from the NPDES permit. A schematic of the wheel and axle facilities as observed July, 1975 is shown in the enclosed Figure.

Current Operations

On the morning of Tuesday, July 15, we collected background data on the wheel and axle plant prior to our Thursday visit. Wheel and axle manufacturing is currently going strong in contrast to iron and steel making. In addition to railroad axles and wheels, some wheels may be made for trucks. Only rarely does McKees Rocks assemble together the railroad car axles and wheels. Machining operations represent critical or "bottleneck" processing at this USSC installation.

The production plants are operating about 15 turns (shifts) per week, i.e., 5 for the wheel plant and around 10 at the axle plant, whereas the machining sections are operating 20 or so turns per week. The 018 Outfall was the site a few weeks ago of a serious oil spill to the Ohio River. It is reported that one or more valves on waste oil storage tanks were inadvertently left open or were not shut off.

The McKees Rocks Plant receives its water supply from a series of 5 or 6 wells. Potable water supply is obtained from the municipality (hence, gross limits on the NPDES permit.) Total water supply currently amounts to about 1 MGD. Average water usage for June, 1975 was recorded as 0.9 MGD. At McKees Rocks, the wheel and axle division no longer maintains a boiler house, generates no steam, and has no water treatment since the boiler house is down. Mention was made of possible conditioning for

hardness but no details were secured. The power plant may still be operational in part, serving air compressors and other essential operations. All waste flows at the wheel and axle plant have been, and continue to be expressed in terms of estimated values. The only known air pollution control equipment at the wheel and axle plant is a wet scrubber installed in 1973 at the shot cleaner station, i.e. where shot is used for surface treatment of railroad wheels. This scrubber has replaced a baghouse previously deployed at this location.

Axle Forge Building and Outfalls 018 and 019

On our visit of Thursday, July 17 to the wheel and axle plant, we first inspected MH018 used for sampling by the Company. This manhole is located in the middle of one of the inner plant roads. On our walk outside the forge and mill buildings, we were joined by a Walt Stern of the wheel and axle plant of USSC. Depth to the sewer from the top of the 018 MH was about 10 feet. This MH has no access ladder. The dye dilution technique is necessary to determine flow on this sewer. A metal cover on 018 can be easily removed and the MH is readily sampled. There is another MH on the 018 line just downstream. For dye injection purposes, it is also possible to add dye at the axle forge furnaces within the axle building, the dye to be subsequently measured at one or both of the downstream manholes.

We entered the axle forge building in the area of billet storage and conditioning. We traversed the building from west to east. The axle building consists entirely of dirt floors. We next passed two axle reheat furnaces. Cooling waters from the reheat furnaces flow to the 018 sewer. Major shaping of axles is carried forth in a single hammer forge machine. This forge stand represents a major source of waste oil and other pollution. Extensive drainings and leakage from the forge stand area are allowed to run into a series of shallow, ground level pits and then picked up into a small collection tank. From this tank, the wastewater flows into an "equivalent" API separator with a surface retainer at the far end. We estimate the oil skim box to have been roughly 4' wide X 14' long X 4' deep. Heavy black oil on the surface of the box is collected and delivered to an oil reclaimer. Underflow from this basin is sent to the 019 waste oil treatment plant. Just behind the surface retainer, we noted a milky-white emulsion on the furthest downstream (effluent) section of the API separator. USSC personnel claimed this was soluble oil. I feel strongly an oil dispersant may have been used.

The forged axles are then passed through a series of three heat treating furnaces. The axles are loaded onto a moving conveyor and arrayed like "rungs on a ladder" for the required heat treatment. The sequence is heating-cooling, heating-cooling, heating-cooling. We observed considerable oil on the floor and around the base of heat treating furnaces. Mc Carthy and Dunham indicated most of the cooling water from these furnaces is recycled for reuse. Contact cooling waters reported as directed to 018

and oily waters are sent to the 019 sewer. Nevertheless, the 018 sewer is believed to receive considerable contact-cooling waters together with oily waters.

The axle building has very extensive machining (lathing et. al.) operations for both the ends and central core of the axles which yield the final product. In and around the machining areas were noted many bins containing accumulations of metal scraps and shavings. Some of these bins were partly filled with liquid drainings. According to Steel, this liquid overburden never reaches the sewer. Metal scraps are said to be totally recycled to the open hearth furnaces at the main Homestead Works. The completed axles grooved at both ends and polished throughout are said to weigh about 600 pounds. The axles are finally taken to the inspection and storage sectors of the plant. Whatever wastewaters (primarily spent cooling flows) originate from the machining and axle finishing sectors, enter Outfall 019. Some of these waste flows are sent to the oil treatment plant, whereas others are bypassed around treatment.

Machine and Repair Shop, Outfall 020

The tour was continued through the repair and machine shop and we were shown sampling point 020 inside a tool-gear storage shop. Besides general repair, this part of the plant specializes in heat-treating, quenching and otherwise manufacturing unique tools for direct use in the wheel and axle plant. The 020 MH was covered with a steel plate having an 8" square opening. Upon removing the plate, it should be possible to descend the MH, a 4' X 4' box with a ladder, some 15' deep. Flow was observed to be extremely slow-moving inside the MH although we could not clearly see inside due to lack of lights. McCarthy estimates this flow to be around 5 gpm. More detail is needed for the 020 manhole. The 020 Outfall is more or less an illegal discharge because the Company has previously officially withdrawn the NPDES permit application for this waste line. The 020 MH may possibly be weired. Otherwise, dye may be added to 020 with subsequent measurement of the dye in Graham Street storm sewer downstream.

019 Sewer and Manhole

The 019 manhole located immediately south of the wheel storage sheds and at the fence line running down Graham Street was inspected. We observed that an 11" square hole had been cut in the metal plate covering the manhole. The manhole itself was approximately 4' X 4' with a ladder descending down to the sewer about 20 feet below ground level. We should request that the Company remove the metal plate during the EPA sampling survey. The ladder appears rusty and corroded, probably due to strong organics and/or acids carried in the sewer. We observed fumes coming off the manhole believed due to organic cleaning solvent and/or degreasers present. The manhole contained a good waste flow. The 019 manhole is located just off Graham Street inside of USSC property. It is also directly across and road from the Pepsi Cola plant approximately 200' east of the Pepsi Cola main gate.

T. P. Gallagher, Director July 23, 1975

The Wheel Mill Buildings

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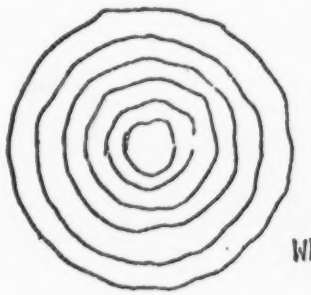
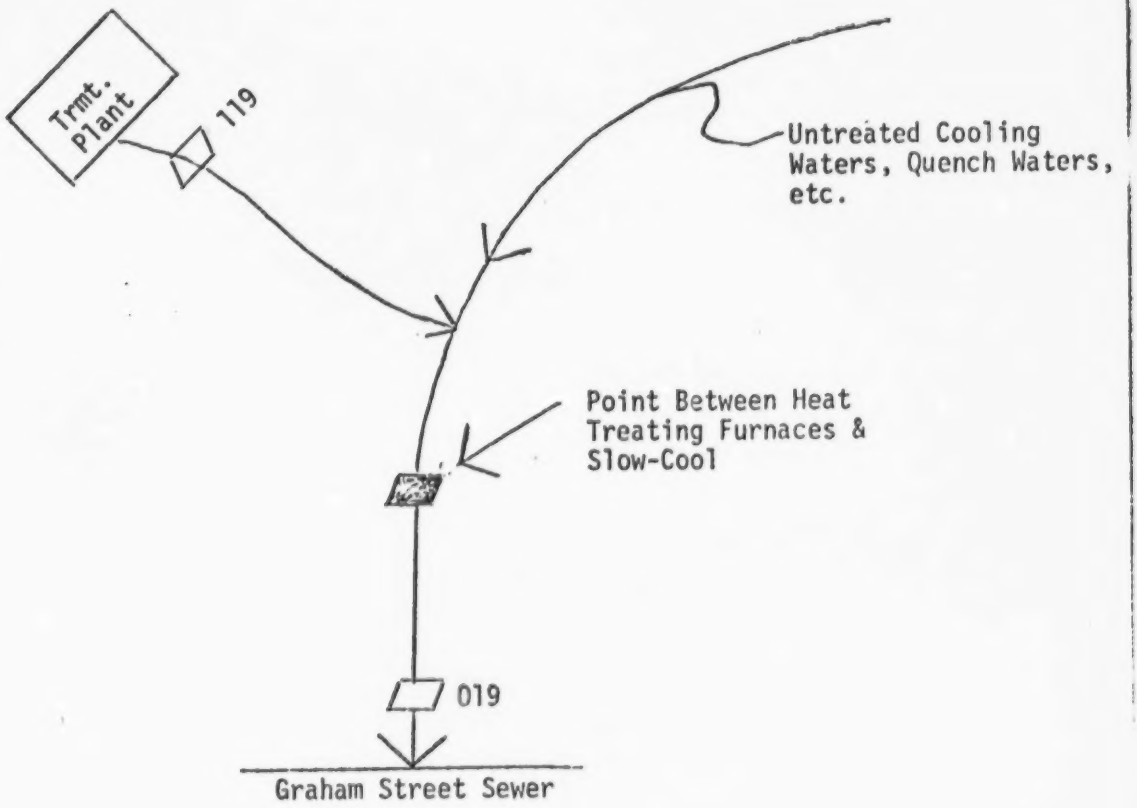
McCarthy stated some of the waste flows in the wheel building going to the 119 treatment plant are subjected to magnetic or sonic separation. Unfortunately, we did not solicit further information on these procedures. At the beginning of the wheel building, we observed wheel "blanks" being being heated in rotary furnaces. A cross section of a typical wheel blank is shown below. Sizes of wheels range from 11" in diameter up to about 40". Off to the side, we observed blanks placed on stands with the interior of the blanks being specially heated with an open flame. The fully heated, red-hot blanks are injected into a stamping or milling machine where the rough wheel is formed via a 2-step operation. Dies are interchanged between the first and second press. The wheels are then received into a second pressing or milling machine serving to widen the wheel and roll out the edges of the wheel. A third machine stamps holes into the wheels. The wheels are then hung up on a continuous conveyer line. Wastewaters from these various furnaces and milling operations are reported to be directed entirely to the 119 treatment plant.



Wheel blank

The wheels hung on the conveyor line are taken through heat treating furnaces. Wheels otherwise may be temporarily stored and later brought through the heat-treating furnaces. The wheels then enter an equalizing tunnel, are subjected to heat treating furnaces a second time, are passed through a (6 unit) wheel quench operation where only the outer rim of the wheel receives quenching, and for a third time, progress through the heat treating or annealing furnaces. The wheel quench operation is served by a scale bucket underneath the machine. Finally, the wheels are passed through a long "Slow-Cool Tunnel" before final polishing, finishing, etc. McCarthy showed us a discharge trough situated between and beneath the heat treatment furnaces and the slow cool tunnel for possible dye dumping and/or for sampling. This location described in the sketch shown on the following page was stated by USSC as approximating the discharge at 019. However, observed flow at this upstream point was much smaller than at MH 019. Practically all spent waters from the axle plant find their way to the 019 sewer except for some trenches/drains feeding to the 018 system.

T. P. Gallagher, Director July 23, 1975



Oil Waste Treatment Plant, 119 Location

We next went through the oil treatment plant. This system is approximately two years old and consists of air injection for flotation; a mix tank where wastes are blended with $FeCl_3$ on a continuous or batch (both reported) basis; a large thickener-settler; 2 scum tanks for oils and flotables (taken to a re-refinery; and 2 sludge underflow storage tanks. The scum tanks comprise one tank in service and one as standby. The sludge underflow tanks are similarly operated. Polymers are added with the $FeCl_3$. The surface layer on top of the thickener was light brown in color and the main contents of the tank were milky-white. We were told effluent from the thickener is ordinarily sampled by the Company as sampling station 119. The thickener has two takeoff pipes for sampling purposes: a) one line to sample scum transfer and; b) a second to sample normal effluent off the thickener. McCarthy stated influent to the thickener varies considerably but can be sampled. The $FeCl_3$ was supposedly added to the top of the mix tank and there was sampling access on the waste line just ahead of the mix tank. However, after tracing the inflow line, it was learned the $FeCl_3$ is added considerably upstream. We were consequently told there is no other access point on the waste inflow but with some difficulty, we are fairly certain another location can be found; this can be done on the next EPA visit to the wheel and axle plant.

A Foxboro recorder is present on the effluent from the waste treatment plant which was reading about 430 gpm during our visit. Effluent (and possibly

influent) is analyzed for pH, turbidity, oils and TSS. The treatment plant operator verbally reported to us that they sample every 2 hours in and out, and rate treatment efficiency in terms of TSS and oil removals. They have had problems with the $FeCl_3$ feed since installation and these difficulties continue. They are getting somewhat less than 90% waste removals. The system is far less effective in soluble oils compared to non-soluble oils. We asked how the influent loads are accounted for. The operator indicated they sample at a number of points in the axle and wheel process operations and they are picking up maybe 90-95% of the waste treatment plant input loads.

We visited a building directly west of the oil treatment plant housing an old pressure type accumulator. This building, including the accumulator, which leaks like a sieve, were all draining to the 018 sewer rather than to the 019 line. This was an example of the trenches/drains contributing to the 018 sewer. These drains merge with axle furnace cooling waters and enter the 018 manhole as a single flow. The large majority of waste flow into the018 MH enters from the east side; flow leaves the 018 MH heading south toward Graham Street.

Graham Street Storm Sewer to Ohio River

We looked for manholes on the Graham Street storm sewer. Diameter of this storm sewer is unknown. We were able to locate an upstream control at a manhole in the middle of the intersection of George Street, Nichol Avenue and Graham Street. However, this manhole was not raised. We were not successful in finding a manhole on the Graham Street sewer below station 020. Considerable flow enters the Ohio River at the foot of Graham Street but this flow was submerged. The terminus of the Graham Street sewer may be sampled but flow cannot be directly measured. Personal contact is strongly suggested with Stowe Twsp. and/or McKees Rocks Boro regarding the Graham Street storm sewer. At the foot of Graham Street, both the smell and sight of oil were observed.

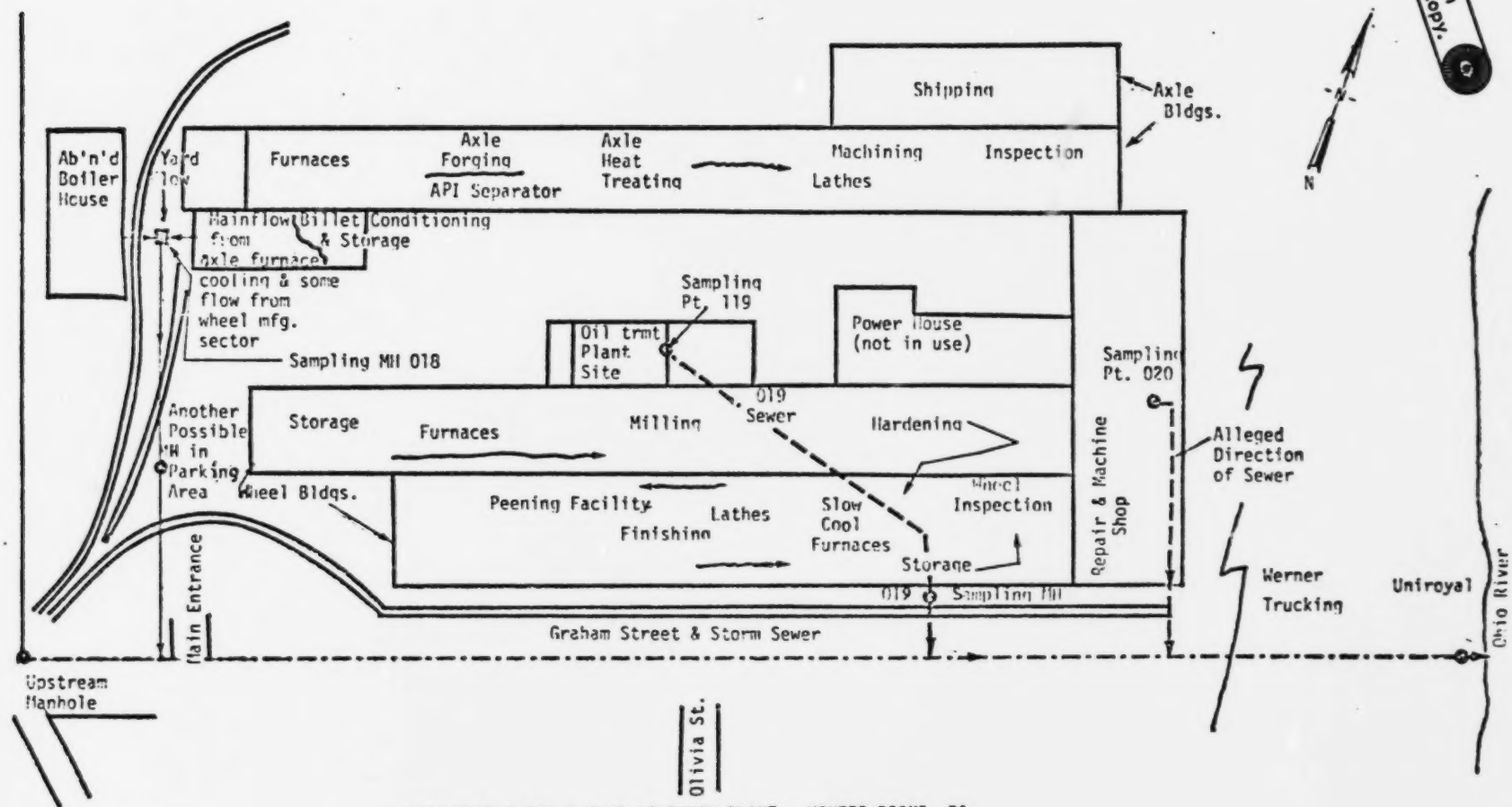
Suggested Sampling Points for Wheel and Axle Plant:

018
Influent to Oil Waste Treatment Plant
119 (Effluent from Treatment Plant)
019
020
Graham Street storm sewer; upstream
Graham Street storm sewer, immediately downstream

Reproduced from best available copy.

GATE

"New" Buildings & Storage Facilities acquired by Wheel & Axle Division approx. 4 years ago



HOMESTEAD WHEEL & AXLE DIVISION PLANT - MCKEES ROCKS, PA.
JULY 1975

Appendix B

Field Study Methods
USSC Homestead Wheel and Axle Plant

FIELD STUDY METHODS

FLOW DETERMINATIONS

Outfall 018

The sampling location is described in the NPDES permit as follows: "Outfall 018 to Graham Street Sewer, which discharges to the Ohio River." For monitoring purposes, the company selected a manhole inside the plant property in the roadway adjacent to the Axle Forge Shop. A 90° V-notch weir was installed by NEIC personnel at the inlet to the effluent pipe from the manhole.[1] A Manning Model F 3000 flow recorder was used to obtain continuous flows over the seven-day period.

Intermediate Location 119

In the amended adjudicatory request, USSC describes the sampling location as "At discharge of treatment plant, sample point 119, which discharges through 019." A sampling port has been installed by USSC in the effluent pipe located inside the treatment plant building. Flows are continuously measured with a Company-installed Foxboro flow recorder. Flows are recorded on a strip chart which is connected to a differential pressure cell. Pressure differential, caused by an orifice plate in the effluent line, is transmitted to the strip chart recorder and is converted into flow. The calibration of the flow device was checked on August 18, 1975 by Wheel and Axle personnel and adjustments were made to indicate correct flows. The calibration procedure was checked by NEIC personnel and was found to comply with the method in the Foxboro instruction manual.

Outfall 019

The NPDES permit describes this sampling location as "Outfall 019 to Graham Street Sewer, which discharges to the Ohio River." Samples were collected by USSC personnel from a pit, approximately 6 m (20 ft) deep, next to the wheel mill. A Marsh-McBirney electromagnetic flow meter [Appendix E] was used by NEIC personnel to measure the instantaneous velocity of the wastewater stream. The flows were calculated from the cross-sectional area of the wastewater stream flowing in the circular pipe.[2]

Outfall 020

No description of the sampling location was contained in the NPDES permit. The sampling location, identified by USSC personnel, is a manhole inside the machine shop. A small quantity of flow was observed discharging from a 30.5 cm (12 in) diameter pipe approximately 2.4 m (8 ft) above the invert of the manhole. A 5 cm (2 in) diameter pipe was installed by NEIC personnel inside the 30.5 cm diameter pipe and sandbagged. Flows, except for a minor leak which could not be measured accurately and which represented less than 1% of the total flow, were measured with a bucket and stop watch. The flow was measured three times when a sample was collected, and the average time was used to compute the instantaneous flow.

Graham Street Sewer, Upstream of Outfall 018

Flows were not measured at this location. Flow was observed during a rain storm on August 26, at 4:15 p.m. USSC personnel stated that the flow was probably due to the Graham Street sewer backing up instead of contributions from upstream connections. All upstream connections to the sewer in Nichol Street from USSC were reported by Company personnel as being plugged.

Graham Street Sewer at Discharge to the Ohio River

Flows were not measured at this location.

Influent to Oil Treatment Plant from Axle Forging Sector

The influent piping to the waste oil treatment plant consisted of a small pipe carrying about 2.84 liters/sec (45 gpm)* from the axle forging sector and about 28.4 liters/sec (450 gpm)* from the wheel mill. Both influent pipes discharged into a common inlet header on the reactor tank. At the header location, only the flow from the axle forging sector could be measured due to the configuration of the influent pipes. This flow was measured with a bucket and stop watch three times whenever a sample was collected, and the average time of the three measurements was used to calculate the instantaneous flow.

Influent to Oil Treatment Plant from Wheel Mill

The flow contributed from the wheel mill was determined by subtracting the axle forge sector influent flow from the total effluent flow. The effluent flow was recorded each time an influent sample was collected and each time an effluent sample was collected.

SAMPLE COLLECTION PROCEDURE

Twenty-Four Hour Composite Samples

Beginning at 6 a.m. on August 21, individual grab samples were collected from each location, except the Graham Street sewer discharge

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* *Flows were provided verbally by USSC Wheel and Axle Plant personnel.*

to the Ohio River, on a 2-hour frequency and stored in an ice chest at 4°C. At the end of 24 hours, these samples were composited on a flow-weighted basis for each station. The Graham Street sewer discharge was continually composited, on a 2-hour frequency, into a 9.5 liter (2.5 gal) cubitainer on an equal-volume basis and stored at 4°C. Beginning at 6 a.m. on August 22, and lasting through the duration of the survey, individual samples were collected on a 3-hour frequency. The time of collection was altered to provide sufficient time for the NEIC field personnel on the 6 p.m. to 6 a.m. shift to collect and composite the samples for the six stations. Table B-1 lists the method used to collect samples from each location.

Grab Samples

Grab samples for oil/grease* and phenols (Outfall 119 only) were collected in 0.95 liter (1 qt) glass jars three times for each 24-hour period. (Times of collection are shown in Table 7 of the main text). Oil/grease samples were preserved with 2 ml H_2SO_4 after collection and stored at 4°C. At outfalls 018 and 019, the glass jars were immersed into the wastewater stream by means of a special sampler** constructed by NEIC personnel for this purpose. At all other stations, the oil/grease samples were manually collected directly into the bottle without using the special sampler. The samples for phenol analysis were collected directly from the sample port into the glass jars. Each jar used for phenol samples contained 1 gram $CuSO_4$ before the sample was collected. After collection, the pH of the sample was reduced to <4.0 with H_3PO_4 and stored at 4°C.

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* *Freon extractable material*
** *Sampler similar to APHA bacti sampler*

Table B-1

COMPOSITE SAMPLE COLLECTION METHOD
HOMESTEAD WHEEL AND AXLE PLANT
August 21-28, 1975

Station Description	Sample Collection Method
Outfall 018	1.9 liter (0.5 gal) plastic† container used to collect sample (container used only for this location). Sample poured into 1.9 liter plastic container and stored at 4°C.
Location 119	Sample collected directly from sample port into 1.9 liter plastic container and stored at 4°C.
Outfall 019	Sample collected directly into 1.9 liter plastic container and stored at 4°C.
Outfall 020	Sample collected directly into 1.9 liter plastic container and stored at 4°C.
Graham St. sewer upstream of Outfall 018	Composite samples not collected since there was no flow except at 4:15 p.m. on August 26.
Graham St. sewer at Ohio River	Sample collected into 1.9 liter plastic container (used only for this location); equal volume measured in plastic graduated cylinder, and poured into 9.5 liter (2.5 gal) plastic† cubitainer stored at 4°C.
Influent to Oil Treatment Plant from Axle Forge Sector	On 6 a.m.-6 p.m. shift, sample collected into stainless steel bucket and poured into 1.9 liter plastic container. On 6 p.m.-6 a.m. shift, sample collected directly into 1.9 liter plastic container. All samples stored at 4°C.
Influent to Oil Treatment Plant from Wheel Mill	Sample collected directly from sample port (in the wheel mill) into 1.9 liter plastic container and stored at 4°C.

† *Polyethylene*

At 10 a.m. on August 25, and at 1 p.m. on August 27, grab samples were collected for analysis for organic constituents. All samples were collected with a 1.8 liter (0.48 gal) stainless steel bucket, poured into a 11.4 liter (3 gal) stainless steel bucket, and then poured into a 3.79 liter (1 gal) brown glass bottle. The bottle contained 8 ml H_2SO_4 and was sealed with a teflon cap. Both stainless steel buckets were rinsed three times with freon, then rinsed three times with the waste stream water prior to sampling. On August 25, a blank consisting of distilled water was prepared identically to the samples collected from the outfalls. The samples were stored at 4°C.

REFERENCES

1. *Water Measurement Manual*, U. S. Dept. Interior, Bureau of Reclamation, Denver, Colo., 1974, Chapters 2 and 6.

2. Ibid, Chapter 5.

Appendix C

Chain-of-Custody Procedures

ENVIRONMENTAL PROTECTION AGENCY
Office Of Enforcement
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
Building 53, Box 25227, Denver Federal Center
Denver, Colorado 80225

July 24, 1974

CHAIN OF CUSTODY PROCEDURES

General:

The evidence gathering portion of a survey should be characterized by the minimum number of samples required to give a fair representation of the effluent or water body from which taken. To the extent possible, the quantity of samples and sample locations will be determined prior to the survey.

Chain of Custody procedures must be followed to maintain the documentation necessary to trace sample possession from the time taken until the evidence is introduced into court. A sample is in your "custody" if:

1. It is in your actual physical possession, or
2. It is in your view, after being in your physical possession, or
3. It was in your physical possession and then you locked it up in a manner so that no one could tamper with it.

All survey participants will receive a copy of the survey study plan and will be knowledgeable of its contents prior to the survey. A pre-survey briefing will be held to re-appraise all participants of the survey objectives, sample locations and Chain of Custody procedures. After all Chain of Custody samples are collected, a de-briefing will be held in the field to determine adherence to Chain of Custody procedures and whether additional evidence type samples are required.

Sample Collection:

1. To the maximum extent achievable, as few people as possible should handle the sample.
2. Stream and effluent samples shall be obtained, using standard field sampling techniques.
3. Sample tags (Exhibit I) shall be securely attached to the sample container at the time the complete sample is collected and shall contain, at a minimum, the following information: station number, station location, date taken, time taken, type of sample, sequence number (first sample of the day - sequence No. 1, second sample - sequence No. 2, etc.), analyses required and samplers. The tags must be legibly filled out in ballpoint (waterproof ink).

Chain of Custody Procedures (Continued)

Sample Collection (Continued)

4. Blank samples shall also be taken with preservatives which will be analyzed by the laboratory to exclude the possibility of container or preservative contamination.

5. A pre-printed, bound Field Data Record logbook shall be maintained to record field measurements and other pertinent information necessary to refresh the sampler's memory in the event he later takes the stand to testify regarding his action's during the evidence gathering activity. A separate set of field notebooks shall be maintained for each survey and stored in a safe place where they could be protected and accounted for at all times. Standard formats (Exhibits II and III) have been established to minimize field entries and include the date, time, survey, type of samples taken, volume of each sample, type of analysis, sample numbers, preservatives, sample location and field measurements such as temperature, conductivity, DO, pH, flow and any other pertinent information or observations. The entries shall be signed by the field sampler. The preparation and conservation of the field logbooks during the survey will be the responsibility of the survey coordinator. Once the survey is complete, field logs will be retained by the survey coordinator, or his designated representative, as a part of the permanent record.

6. The field sampler is responsible for the care and custody of the samples collected until properly dispatched to the receiving laboratory or turned over to an assigned custodian. He must assure that each container is in his physical possession or in his view at all times, or locked in such a place and manner that no one can tamper with it.

7. Colored slides or photographs should be taken which would visually show the outfall sample location and any water pollution to substantiate any conclusions of the investigation. Written documentation on the back of the photo should include the signature of the photographer, time, date and site location. Photographs of this nature, which may be used as evidence, shall also be handled recognizing Chain of Custody procedures to prevent alteration.

Transfer of Custody and Shipment:

1. Samples will be accompanied by a Chain of Custody Record which includes the name of the survey, samplers signatures, station number, station location, date, time, type of sample, sequence number, number of containers and analyses required (Fig. IV). When turning over the possession of samples, the transferor and transferee will sign, date and time the sheet. This record sheet

Chain of Custody Procedures (Continued)

allows transfer of custody of a group of samples in the field, to the mobile laboratory or when samples are dispatched to the NFIC - Denver laboratory. When transferring a portion of the samples identified on the sheet to the field mobile laboratory, the individual samples must be noted in the column with the signature of the person relinquishing the samples. The field laboratory person receiving the samples will acknowledge receipt by signing in the appropriate column.

2. The field custodian or field sampler, if a custodian has not been assigned, will have the responsibility of properly packaging and dispatching samples to the proper laboratory for analysis. The "Dispatch" portion of the Chain of Custody Record shall be properly filled out, dated, and signed.

3. Samples will be properly packed in shipment containers such as ice chests, to avoid breakage. The shipping containers will be padlocked for shipment to the receiving laboratory.

4. All packages will be accompanied by the Chain of Custody Record showing identification of the contents. The original will accompany the shipment, and a copy will be retained by the survey coordinator.

5. If sent by mail, register the package with return receipt requested. If sent by common carrier, a Government Bill of Lading should be obtained. Receipts from post offices and bills of lading will be retained as part of the permanent Chain of Custody documentation.

6. If samples are delivered to the laboratory when appropriate personnel are not there to receive them, the samples must be locked in a designated area within the laboratory in a manner so that no one can tamper with them. The same person must then return to the laboratory and unlock the samples and deliver custody to the appropriate custodian.

Laboratory Custody Procedures:

1. The laboratory shall designate a "sample custodian." An alternate will be designated in his absence. In addition, the laboratory shall set aside a "sample storage security area." This should be a clean, dry, isolated room which can be securely locked from the outside.

2. All samples should be handled by the minimum possible number of persons.

3. All incoming samples shall be received only by the custodian, who will indicate receipt by signing the Chain of Custody Record Sheet

accompanying the samples and retaining the sheet as permanent records. Couriers picking up samples at the airport, post office, etc. shall sign jointly with the laboratory custodian.

4. Immediately upon receipt, the custodian will place the sample in the sample room, which will be locked at all times except when samples are removed or replaced by the custodian. To the maximum extent possible, only the custodian should be permitted in the sample room.

5. The custodian shall ensure that heat-sensitive or light-sensitive samples, or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained.

6. Only the custodian will distribute samples to personnel who are to perform tests.

7. The analyst will record in his laboratory notebook or analytical worksheet, identifying information describing the sample, the procedures performed and the results of the testing. The notes shall be dated and indicate who performed the tests. The notes shall be retained as a permanent record in the laboratory and should note any abnormalities which occurred during the testing procedure. In the event that the person who performed the tests is not available as a witness at time of trial, the government may be able to introduce the notes in evidence under the Federal Business Records Act.

8. Standard methods of laboratory analyses shall be used as described in the "Guidelines Establishing Test Procedures for Analysis of Pollutants," 38 F.R. 28758, October 16, 1973. If laboratory personnel deviate from standard procedures, they should be prepared to justify their decision during cross-examination.

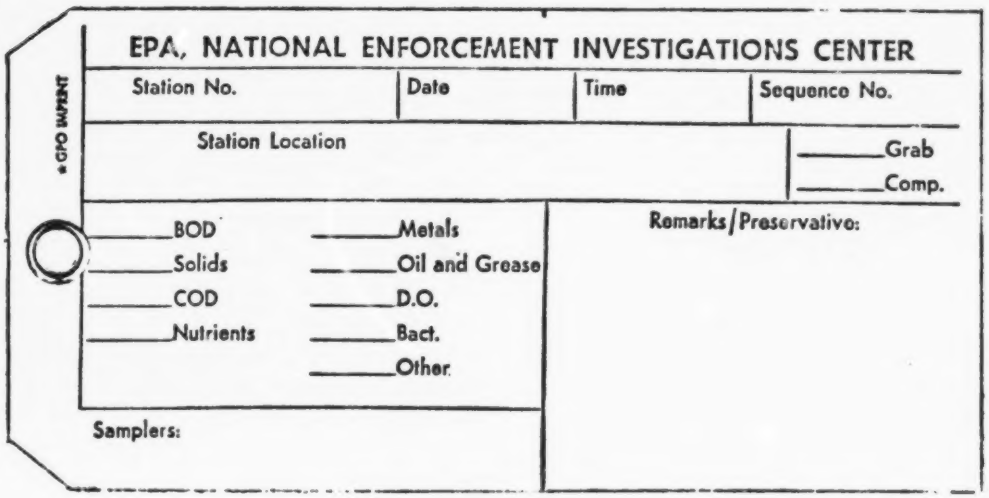
9. Laboratory personnel are responsible for the care and custody of the sample once it is handed over to them and should be prepared to testify that the sample was in their possession and view or secured in the laboratory at all times from the moment it was received from the custodian until the tests were run.

10. Once the sample testing is completed, the unused portion of the sample together with all identifying tags and laboratory records, should be returned to the custodian. The returned tagged sample will be retained in the sample room until it is required for trial. Strip charts and other documentation of work will also be turned over to the custodian.

Chain of Custody Procedures (Continued)

11. Samples, tags and laboratory records of tests may be destroyed only upon the order of the laboratory director, who will first confer with the Chief, Enforcement Specialist Office, to make certain that the information is no longer required or the samples have deteriorated.

EXHIBIT I



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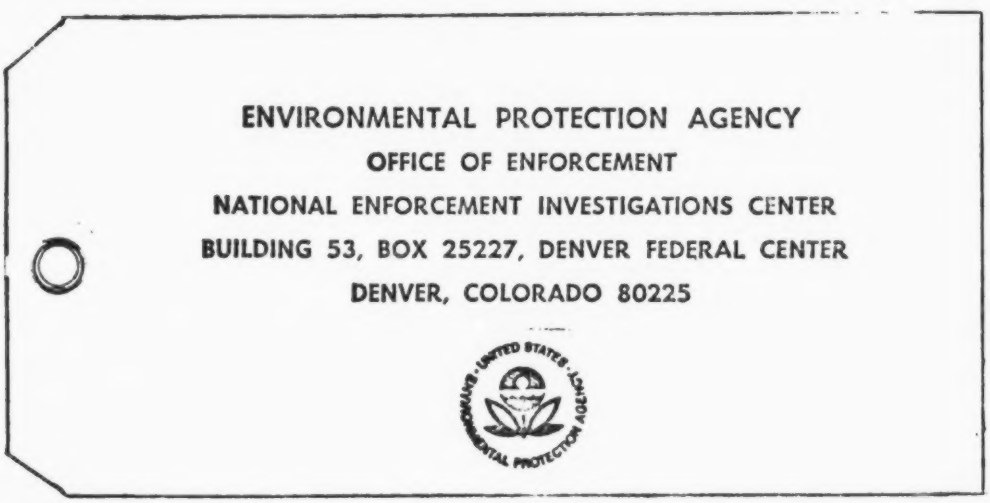
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
BUILDING 53, BOX 25227, DENVER FEDERAL CENTER
DENVER, COLORADO 80225
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Back

EXHIBIT II

FOR _____ SURVEY, PHASE_____, DATE _____

TYPE OF SAMPLE_____

ANALYSES REQUIRED

STATION NUMBER	STATION DESCRIPTION	TOTAL VOLUME	TYPE CONTAINER	PRESERVATIVE	NUTRIENTS	BOD	COD	TOC	TOTAL SOLIDS	SUSPENDED SOLIDS	ALKALINITY	DO	pH*	CONDUCTIVITY*	TEMPERATURE*	TOTAL COLIFORM	FECAL COLIFORM	TURBIDITY	OIL AND GREASE	METALS	BACTI	PESTICIDES	HERB	TRACE ORGANICS	PHENOL	CYANIDE

REMARKS

EXHIBIT III

Samplers: _____

FIELD DATA RECORD

STATION	NUMBER	DATE	TIME	TEMPERATURE °C	CONDUCTIVITY μmhos/cm	pH S.U.	D.O. mg/l	Gage Ht. or Flow Ft. or CFS

EXHIBIT IV

ENVIRONMENTAL PROTECTION AGENCY
Office Of Enforcement
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
Building 53, Box 25227, Denver Federal Center
Denver, Colorado 80225

CHAIN OF CUSTODY RECORD

SURVEY	SAMPLERS: *(Signature)*

STATION NUMBER	STATION LOCATION	DATE	TIME	SAMPLE TYPE			SEQ. NO.	NO OF CONTAINERS	ANALYSIS REQUIRED
				Water		Air			
				Comp.	Grab				

Relinquished by: *(Signature)*	Received by: *(Signature)*	Date/Time
Relinquished by: *(Signature)*	Received by: *(Signature)*	Date/Time
Relinquished by: *(Signature)*	Received by: *(Signature)*	Date/Time
Relinquished by: *(Signature)*	Received by Mobile Laboratory for field analysis: *(Signature)*	Date/Time

Dispatched by: *(Signature)*	Date/Time	Received for Laboratory by:	Date/Time
Method of Shipment:			

Distribution: Orig. – Accompany Shipment
1 Copy – Survey Coordinator Field Files

GPO 854 – 8[illegible]

Appendix D

Analytical Procedures and Quality Control

ANALYTICAL PROCEDURES AND QUALITY CONTROL

Samples collected during this survey were analyzed, where appropriate, according to procedures approved by EPA for the monitoring to industrial effluents.* The analytical procedures for characterizing trace organic chemical pollutants are described below. The remaining procedures are listed in the following table.

Parameter	Method	Reference
Al, Cr, Fe, Pb, Sn	Atomic absorption	EPA Methods for Chemical Analyses of Water and Wastewater, 1971, p 83
TSS	Gravimetric	ibid., p 278
Phenol	Automated Colorimetric	EPA Methods for Chemical Analyses of Water and Wastes, 1974, p 243
Oil and grease	Freon extraction	Standard Methods 13th Ed., p 254

Samples for organic chemical pollutant analysis were collected in clean, solvent rinsed one-gallon glass containers. These samples were air freighted to Denver and extracted with methylene chloride. The extract was dried with anhydrous sodium sulfate, concentrated, exchanged into acetone, and analyzed by hydrogen flame ionization gas chromatography. Those samples that showed adequate response were set aside for characterization by combined gas chromatography-mass spectrometry (GC/MS). The GC/MS analyses were carried out with a Finnigan Model 1015 Quadropole Mass Spectrometer and a Systems Industries Model 150 computerized data system. Mass spectra were compared to data files in the

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NIH Computer System and also to listings in the *Eight Peak Index of Mass Spectra*, Second Edition, 1974, compiled by the Mass Spectrometry Data Center. All identifications are considered preliminary until authentic standards of the suspected chemical compounds can be obtained and analyzed under similar conditions to match the mass spectrum and gas chromatographic retention time. This procedure does not detect highly volatile organic chemical pollutants since their presence is masked by the extraction solvent.

Reliability of the analytical results was documented through an active Analytical Quality Control Program. As part of this program, replicate analyses were normally performed with every tenth sample to ascertain the reproducibility of the results. In addition, where appropriate, every tenth sample was spiked with a known amount of the constituents to be measured and reanalyzed to determine the percent recovery. These results were evaluated in regard to past AQC data on the precision, accuracy, and detection limits of each test. On the basis of these findings, all analytical results reported for the survey were found to be acceptable with respect to the precision and accuracy control of this laboratory.

Appendix E

Marsh-McBirney Flow Meter

FLOW MEASUREMENT USING THE MARSH-McBIRNEY ELECTROMAGNETIC FLOW METER

The flow meter is provided with a Faraday-type electromagnetic flow sensor which has two perpendicular axes so that both X and Y directional vectors can be measured. The operator can obtain from the measurement both the direction and magnitude of the water velocity. All sensors are cylindrically shaped and have no moving parts which are susceptible to clogging or fouling.

The sensor consists of a cylinder containing an electromagnet internally and two pairs of external electrodes in contact with the water. Flow around the cylinder probe intersects magnetic flux lines causing voltages to be generated which are linearly proportional to the water velocity. The voltages are detected by the electrodes, processed at the signal conditioner and presented as analog voltages linearly proportional to the X and Y components of the velocity vector.

The accuracy of an electromagnetic sensor includes linearity, zero drift, and absolute calibration. Linearity allows direct reading without a correction chart and accurate recording of steady flow in the presence of fluctuations. All March-McBirney instruments are accurate to at least $\pm 2\%$ of reading or ± 0.07 feet per second, whichever is larger.